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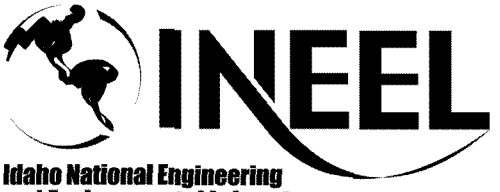
Construction Specification

PROJECT NO. 23095

WAG 1, Operable Unit 1-10, Group 3, TSF-26 PM-2A Tanks Remedial Design



Idaho National Engineering
and Environmental Laboratory

Form 412.14
10/9/2003
Rev. 05

SPECIFICATIONS
FOR
WAG 1, OPERABLE UNIT 1-10, GROUP 3,
TSF-26 PM-2A TANKS REMEDIAL DESIGN

Prepared for:

U.S. DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE

Idaho Falls, Idaho

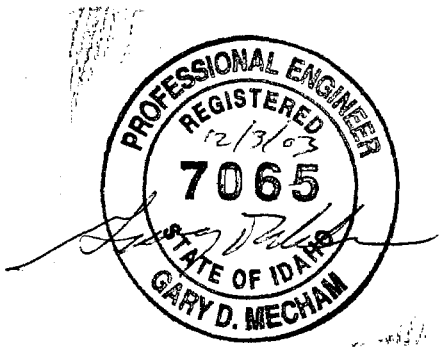
Project File No. 23095

December 2003

BECHTEL BWXT IDAHO, LLC (BBWI)
Idaho Falls, Idaho 83415

Project Title:	**WAG 1, OPERABLE UNIT 1-10, GROUP 3, TSF-26 PM-2A TANKS REMEDIAL DESIGN**		
Document Type:	**Construction Specifications**	**Project Number:**	**23095**
SPC Number:	**475**	**Revision Number:**	**0**

The following Sections of this Specification were prepared under the direction of the Professional Engineer as indicated by the seal and signature provided on this page. The Professional Engineer is registered in the State of Idaho to practice Mechanical Engineering.



Division 1 – General Requirements

01005 – Summary of Work

Division 13 – Special Construction

13121 – Vacuum System
13124 – DOT 7A Type A Waste Boxes
13130 – DE Delivery System
13400 – Instruments and Equipment

Division 15 – Mechanical

15025 – Steel Structural Welding
15404 – Piping and Plumbing
15810 – Ventilation and Tank Cover
15883 – HEPA Filter Housing

Project Title:	**WAG 1, OPERABLE UNIT 1-10, GROUP 3, TSF-26 PM-2A TANKS REMEDIAL DESIGN**		
Document Type:	**Construction Specifications**	**Project Number:**	**23095**
SPC Number:	**475**	**Revision Number:**	**0**

The following Sections of this Specification were prepared under the direction of the Professional Engineer as indicated by the seal and signature provided on this page. The Professional Engineer is registered in the State of Idaho to practice Civil Engineering.

Division 1 – General Requirements

01051 – Construction Surveying and Staking

Division 2 – Site Work

02140 – Temporary Diversion and Control of Water during Construction
02200 – Earthwork
02430 – Storm Drain
02486 – Revegetation

Division 3 – Concrete

03301 – Concrete

Project Title:	**WAG 1, OPERABLE UNIT 1-10, GROUP 3, TSF-26 PM-2A TANKS REMEDIAL DESIGN**		
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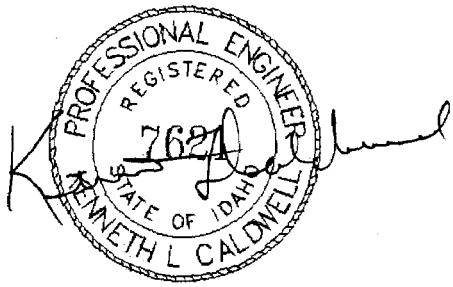
SPC Number:	**475**	**Revision Number:**	**0**

The following Sections of this Specification were prepared under the direction of the Professional Engineer as indicated by the seal and signature provided on this page. The Professional Engineer is registered in the State of Idaho to practice Electrical Engineering.



Division 16 – Electrical

16000 – Electrical General Provisions
16120 – Cable, Wire, Connectors, and Miscellaneous Devices
16160 – Panelboards
16450 – Grounding
16460 – Transformers, General Lighting and Distribution Dry Type, Indoor and Outdoor, under 600V

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WAG 1, OPERABLE UNIT 1-10, GROUP 3,
TSF-26 PM-2A TANKS REMEDIAL DESIGN

SECTION 01005--SUMMARY OF WORK

PART 1--GENERAL

SUMMARY:
The expected implementation of work (i.e. excavation, tank contents removal, backfilling, etc.) will be performed by the INEEL operating contractor, while systems and components will be procured as necessary by subcontractors. All sections within this specification are written as if the work is being performed by a subcontractor. The contractor may use any applicable and appropriate sections of this specification for the individual procurement activities deemed necessary.

The Subcontractor shall furnish labor, material, equipment, and supplies and perform work and operations necessary to complete the OU 1-10 TSF-26 remedial activity in accordance with the RD/RA Work Plan, subcontract drawings, and these specifications.

Section Includes: Work includes, but is not limited to:

Earthwork –Furnish labor, materials, and equipment necessary for the excavation of the PM-2A tanks, water control, backfilling of all excavation, compacting of all backfill, and finish grading for surface drainage.

Tank Removal – Furnish all labor, materials and equipment necessary to cut and remove the top sections of the PM-2A tanks, remove and package the tank contents, and remove the bottom sections of the PM-2A tanks in accordance with the OU 1-10 TSF-26 RD/RA WP.

Mechanical Equipment: Design, test, install, and provide technical support for the vacuum extraction system, Brokk 330D vehicle with manipulator arm and SBC 610 end effecter (including standard 800 mm long moil point tool and an additional 800 mm long, 230 mm wide asphalt cutter tool) and RF camera system (4 cameras, one to rear, two to front, and one on end effecter) to perform the work described herein.

Electrical – Furnish labor, material, equipment, supplies, install and test electrical lines as shown on the subcontract drawings and specified in the 16000 series sections.

RELATED SECTIONS:
Section 01051 – Construction Surveying and Staking
Section 02140 – Temporary Diversion and Control of Water during Construction
Section 02200 – Earthwork
Section 02430 – Storm Drain
Section 02486 – Revegetation
Section 03301 – Concrete
Section 13121 – Vacuum System
Section 13124 – DOT 7A Type A Waste Boxes
Section 13130 – DE Delivery System
Section 13400 – Instruments and Equipment
Section 15025 – Steel Structural Welding
Section 15404 – Piping and Plumbing
Section 15810 – Ventilation and Tank Cover
Section 15883 – HEPA Filter Housing

Section 16000 – Electrical General Provisions
Section 16120 – Cable, Wire, Connectors, and Miscellaneous Devices
Section 16160 – Panelboards
Section 16450 – Grounding
Section 16460 – Transformers, General Lighting and Distribution Dry Type, Indoor and Outdoor, under 600V

REFERENCES:
The following documents, including others referenced therein, form part of this Section to the extent designated herein.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 OSHA General Industry Safety Standards
29 CFR 1926 OSHA Construction Industry Safety Standards

Bechtel BWXT Idaho, LLC (BWXT)

Subcontractors Requirements Manual

Equipment furnished and tasks performed shall adhere to requirements outlined in TFR-234.

Unless otherwise specified, references in these specifications and on the remedial design drawings shall be the latest edition, including any amendments and revisions, in effect as of the date of this Specification.

SUBMITTALS: Submittals are listed in the related sections and vendor data schedule and include but are not limited to the following:

Shop/Design Drawings and Vendor Data: Copies of shop drawings and vendor data, as required by the Vendor Data Schedule and specification sections for materials and equipment to be furnished by the Subcontractor shall be submitted by the Subcontractor. When the Subcontractor proposes an "equal" item, data shall be submitted to the Contractor in such detail to clearly illustrate that the item, including components and fabrication thereof, or that adjustment of features to make the item "equal", meets requirements of the subcontract drawings and specifications. The Subcontractor shall submit data for "equal" approval and obtain the Contractor's approval before committing to purchase the proposed "equal" item.

Manufacturers' Operation and Maintenance Manuals: The Subcontractor shall furnish a minimum of 6 copies (unless additional copies are required in the vendor data schedule) of installation, operating and maintenance manuals, for operating equipment and systems, as required by the Vendor Data Schedule and specification sections. Manuals shall be prepared by the manufacturers and fabricators of the operating equipment or systems furnished and installed under these specifications.

Manuals shall be complete and shall include instructions and sufficient data for lubricating, start-up sequence, operating instructions, special test procedures or instructions recommended by the manufacturer, maintenance procedures, a complete parts list and recommended list of spare parts for normal expected maintenance. Wiring diagrams shall be furnished for electrically operated equipment.

The required number of manuals shall be furnished to the Contractor at least 14 calendar days prior to the start of any operational testing or system delivery.

Hazardous Chemicals and Substances: Subcontractor shall submit a Chemical Inventory List (Form 432.21) identifying all hazardous chemicals and substances that will be brought onto the INEEL for mandatory approval. Chemicals and substances not previously approved for use will require the submittal of MSDS for mandatory approval.

See the Vendor Data Schedule for additional submittal requirements.

QUALITY ASSURANCE:
Quality Assurance Program requirements shall exist to assure that work performed is in conformance with the requirements established by the drawings and this specification. The subcontractors approved Quality Assurance Program and/or plan shall be implemented as indicated on the Checklist of Subcontractor Requirements for On-Site Work, Form 540.10 and as applicable to the contract scope of work. The requirements of MCP-538, "Control of Non-Conforming Items" shall also be addressed.

Standard Products: The materials and equipment furnished by the Subcontractor shall be standard products of manufacturers regularly engaged in the production of the type of materials and equipment required and shall be of the manufacturer's latest standard designs. Where two or more units of the same type and class of material or equipment are required, the units shall be the product of the same manufacturer, and shall be identical insofar as possible. The component parts of a unit of equipment need not be the products of the manufacturer.

General: Construction materials and equipment, flange facings, threads, machined or painted, and other exposed finished surfaces shall be protected from damage at all times during shipping, handling, construction and installation. Materials and equipment repaired or replaced by the Subcontractor shall be subject to acceptance by the Contractor.

SAFETY, HEALTH AND ENVIRONMENT:
Work shall be performed in compliance with the applicable sections of 29 CFR 1910, 29 CFR 1926, the Project HASP, and the INEEL Construction Management Environmental, Health, and Safety Requirements.

DELIVERY STORAGE AND HANDLING
All materials normally packaged shall be delivered to the site in the original, unopened packages with labels intact. Upon arrival, the Subcontractor shall inspect the materials or equipment for damage.

Materials and equipment shall be stored and handled in accordance with the manufacturer's instructions.

PART 2--PRODUCTS

MATERIALS:
New Materials and Equipment: Materials and equipment received by the Subcontractor in a damaged condition shall be repaired or replaced by the Subcontractor as directed by the Contractor. Materials and equipment damaged by the Subcontractor shall be repaired or replaced by the Subcontractor.

Existing Materials, Equipment and Structures: Existing materials, equipment and structures, including paint and protective coatings, involved under this Subcontract shall be thoroughly inspected by the

Subcontractor before starting any work. Any defects or damages, the repair of which are not covered under these specifications or subcontract drawings, shall be reported in writing to the Contractor by the Subcontractor. The Subcontractor shall place reinstalled operating equipment in an operating condition that is at least as good as it was at the time the Subcontractor started work.

Hazardous Chemicals and Substances: The Subcontractor shall comply with applicable requirements of 29 CFR 1926.59, Hazard Communication Standard.

SPECIALTY ITEMS

SP-101, Vacuum System (Ref. section 13121)
SP-102, Metal Waste Box (Ref. section 13124)
SP-104, HEPA Filter Housing (FL-102 and FL-103, Ref. section 15883)
SP-105, HEPA Filter Housing (FL-104 and FL-105, Ref. section 15883)
SP-106, Check Valve (CV-101 and CV-102, CONBRACO 62-108-01, Ref. section 15404)
SP-107, Vacuum Relief Valve (PRV-101, CONBRACO 14-297-W2, Ref. section 13400)
SP-108, Fan (F-101 and F-102, ACME Fan 2115 with partial width wheel, Ref. section 15810)
SP-109, Mobile Manipulator, (BROKK 330D with SBC 610 end effector and 4 ea. RF cameras)
SP-110, Weather Enclosure, (Rubb THA 26'W x 65'L x 11'H sidewall, Ref. Drawings M-2 and M-7)
SP-111, Vacuum System Enclosure, (Rubb BVR 16'W x 35'L x 22'H sidewall, Ref. Drawings M-2 and M-7).

Note: All specialty items may be substituted with an "equal" equipment items if the vendor information for that item is submitted for approval prior to purchase.

PART 3--CONSTRUCTION AND INSTALLATION

General: Materials and equipment shall be erected or installed only by qualified and appropriately trained per INEEL requirements personnel who are regularly engaged in the trades required to complete the work. The subcontract drawings show the general arrangement and space allocation of the equipment specified. It shall be the Subcontractor's responsibility to verify changes in conditions or rearrangements necessary because of substitutions for specified materials or equipment and to coordinate interface between lab/office and metal building systems. Where rearrangements are necessary the Subcontractor shall, before construction or installation, prepare and submit drawings of the proposed rearrangement for approval.

Coordination of Work: Where new work and existing facilities are shown on the drawings, but are not located precisely by dimensions, the Subcontractor shall be responsible for proper location and clearances and for correcting discrepancies and interferences in the work, which are a result of his operations. Work done by one trade that must be integrated with work of other trades shall be laid out with due regard to the work done, or to be done, by other trades; particularly if the work done by one trade depends upon completion or proper installation of work done by other trades. The Subcontractor shall cooperate in coordinating his work with work being done by others if their work must be integrated with the Subcontractor's work. The Subcontractor shall notify the Contractor at least one week prior to starting of the date on which the Subcontractor proposes to proceed with the work.

Subsurface Investigation: Prior to any excavation activities, an approved outage request shall be obtained by completing and submitting an outage request in accordance with the General Provisions. In addition the contractor will perform a subsurface investigation to determine the location of buried utilities and piping. The subcontractor will be required to comply with all contractor and OSHA requirements during

excavation activities and hand excavation will be required in the vicinity of buried items in accordance with the General Provisions.

Workmanship: The Subcontractor shall do structural cutting, fitting, patching, repairing and associated work necessary for installation of equipment, piping and electrical conduits, etc. No major cuts or holes, not shown on the drawings, shall be made without prior approval of the Contractor. After the equipment and/or piping is installed, exposed holes, cracks and other defects shall be neatly patched and the patched areas shall match the adjoining materials and finish.

END OF SECTION 01005

SECTION 01051--CONSTRUCTION SURVEYING AND STAKING

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

The subcontractor will furnish all materials, labor, tools, and equipment to perform surveying. The subcontractor will perform surveying to ensure that the proper grades, lines, and levels are established as set forth in these specifications and as shown on the design drawings. The construction survey will be completed under the supervision of a Registered Professional Land Surveyor licensed in the State of Idaho.

Related Sections:

a) Section 02140, Temporary Diversion and Control of Water During Construction
b) Section 02200, Earthwork
c) Section 02430, Storm Drain
d) Section 02486, Revegetation

Work to be Performed by Others:

The Contractor will:

a) Review and approve data submittals as required by this specification
b) Provide INEEL survey grid information
c) Provide benchmarks, strategically located, as shown on design drawings
d) Inspect work for compliance with this specification, in addition to inspection by the subcontractor.
e) Perform final inspection and acceptance of water diversion and control work.

SUBMITTALS:

Procedures:

a) The subcontractor will submit within eight work days after notice to proceed, a plan for the work, including descriptions of survey equipment, procedures used to establish temporary or permanent benchmarks or measurements, field notes, calculations, reductions, closures, and documentation for any benchmarks or monuments to the contractor for approval.
b) Data will be reduced and plotted by the subcontractor in a form acceptable to the contractor. Legible notes, drawings, and reproducible documentation will be submitted to the contractor for approval. Contour intervals will be 0.5 feet. In addition to the above notes submittals, all plans will also be submitted in ASCII (data) and AutoCAD 2002 (drawings) formats on CD-ROM.

Certifications:

a) Provide evidence of surveyor's current registration in the State of Idaho.
b) Prior to grading or placing fill at the site, the subcontractor will perform a survey of the existing subgrade, if necessary, to confirm to his satisfaction the adequacy of the existing topography as shown on the drawings. The Subcontractor will submit a letter to the contractor stating acceptance of the accuracy of the existing topography shown on the contract drawings, or will otherwise advise of discrepancies or omissions for further resolution. Construction work in each respective area will not begin until agreement is reached on the adequacy of the existing topographic information.

Records: The subcontractor will submit to the contractor for information, all field notes from surveying and layout activities within four work days after completion of each stage of these activities at each respective site.

QUALITY CONTROL:
Qualifications: Construction surveying and staking shall be accomplished under the direction of a registered professional land surveyor licensed in the State of Idaho.

PART 2--PRODUCTS

Stakes: Identification stakes and hubs shall be of sufficient length, width and depth to provide a solid set in the ground and to provide space for marking above ground when applicable. The top 2-in. of all slope, guard, reference, clearing, and structure stakes shall be painted or marked with plastic flagging.

Monuments: Permanent monuments shall be supplied and placed in accordance with applicable INEEL, State and Federal standards as shown in the drawings.

PART 3--EXECUTION

SURVEY REQUIREMENT:
Precision: Precision and accuracy requirements are contained in Table 1. Precision B shall be used.

Control: Prior to commencement of construction work, the subcontractor will establish survey control points inside the work areas. Survey control points will be established so that any point within the job site can be accurately reestablished and elevations be obtained to the required tolerances at any time during the construction. The subcontractor will verify all baselines, and horizontal and vertical control benchmarks stipulated in the information provided by the contractor.

Slope Stakes, Clearing Limits and Reference Stakes: Slope catch-points, clearing limits, and slope reference stakes shall be established. The position of these stakes shall be determined by methods that will produce on the ground the precisions shown in the Table 1.

Clearing limits shall be set within the tolerance shown in the Table 1. The clearing limit shall be located on the ground and marked with lath, flagging, or other methods approved by the Contractor's Representative.

The elevation and location of slope reference stakes shall be verified for accuracy by a differential level run over the reference stakes between benchmarks.

Monuments of Property Boundaries or Surveys of Other Agencies: If property boundary or survey monuments, or survey markers of other agencies, are found within or adjacent to the construction limits, the Subcontractor shall immediately notify the Contractor's Representative. These monuments shall not be disturbed. If disturbance is necessary to complete the work, monuments shall be reestablished to the original coordinates prior to final completion. The exception is the four known and previously disturbed monuments over the PM-2A tank cradle. These monuments are to be surveyed to permit reestablishment of the corners they mark for reference during excavation, and disposed of in accordance with section 02200 of these specifications.

Grade Finishing Stakes: Stakes shall be set on a 50-ft grid and at the shoulders. Subgrade finishing stakes shall be red tops and finish grade stakes shall be blue tops.

Finishing stakes shall be set when subbase is within 0.2 ft, or topsoil is within 0.1 ft of final grade. The stakes shall be set to the nearest 0.01 ft of the measured grade line.

TABLE 1. CROSS SECTION AND SLOPE-STAKE PRECISION

Item	Precision		
	A	B	C
Allowable deviation of cross section line projection from a true perpendicular to tangents, a true dissector of angle points, or a true radius of curves.	±2_	±3_	±3_
Cross section topography measurements shall be taken so that variations in ground from a straight line connecting the cross section points will not exceed:	0.5 ft	1.0 ft	2.0 ft
Horizontal and vertical accuracy for cross sections. In feet or percentage of horizontal distance measured from transverse line, whichever is greater.	.05 ft or 0.2%	0.15 ft or 0.6%	0.2 ft or 1.0%
Horizontal and vertical accuracy for slope stake, slope stake references, and clearing limits. In feet or percentage of horizontal distance measured from centerline or reference stake, whichever is greater.			
a. Slope reference stakes and slope stakes.	0.1 ft or 0.4%	0.15 ft or 0.6%	0.2 ft or 1.0%
b. Clearing limits.	1.0 ft	1.0 ft	1.0 ft

FIELD QUALITY CONTROL:
The subcontractor is responsible for controlling lift thickness to ensure conformance to the required dimensions. The subcontractor will be responsible for establishing, recording, protecting, and maintaining all permanent and temporary horizontal and vertical control benchmarks.

Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 01051

SECTION 02140—TEMPORARY DIVERSION AND CONTROL OF WATER DURING CONSTRUCTION

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

Furnishing of all materials, labor, tools, and equipment for dewatering work areas and controlling surface water prior to and throughout construction operations. Control measures implemented may include berms, swales, ditches, temporary piles, portable pumps, silt fences, sediment traps, or any other measure approved by the contractor in accordance with this specification and as shown on the design drawings.

Related Sections:

a) Section 02200, Earthwork
b) Section 02430, Storm Drain

Work to be Performed by Others:

The Contractor will:

a) Review and approve data submittals as required by this specification
b) Inspect work for compliance with this specification and the design drawings, in addition to inspection by the subcontractor. The contractor will review pre-placement conditions, placement of controls, and other job conditions during performance of the work.
c) Perform final inspection and acceptance of water diversion and control work.

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein.

a) Health and Safety Plan (HASP) for the Remedial Action Waste Group 3, Operable Unit 1-10
b) Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North Operable Unit 1-10, Selected Sites

SUBMITTALS:

Procedures: Storm water control procedure and dust control procedures shall be submitted for approval prior to the start of the work detailing the subcontractor's proposed storm water control measures. The procedures must meet the requirements specified in the project Environmental Checklist and shall be approved by the contractor and implemented as approved before excavation may begin, and shall comply with the preliminary grading plan shown in the drawings.

Records: The Subcontractor will submit all records of inspection to the contractor within four work days after completion of the inspection.

PART 2--PRODUCTS

EQUIPMENT:

a) All equipment and tools will conform to the safety requirements of the Project Health and Safety Plan (HASP)
b) All equipment and tools used by the subcontractor to perform the work will be subject to inspection by the contractor before the work is started and will be maintained in satisfactory

working condition at all times.

c) The subcontractor's equipment and work will be adequate and capable of controlling water prior to and throughout construction as required by this specification and the design drawings.

MATERIALS:

a) All materials will be furnished by the subcontractor and will be subject to approval by the contractor

b) Selection of materials used for controlling storm water are the responsibility of the subcontractor, but will follow the intent of the Storm Water Pollution Prevention Plan and be approved by the contractor.

PART 3--EXECUTION

GENERAL:

a) All standing water outside the construction boundary may be left to infiltrate the soil.

b) The subcontractor will perform all construction work in areas free of standing water. Suitable water control measures will be constructed at all locations where construction work may be affected by ponded storm water at the time of work.

c) The subcontractor will divert surface water around the periphery of all construction areas by applying the preliminary grading plan as outlined in the drawings.

d) The subcontractor will be solely responsible for the protection of work against damage, delay, or environmental impact by water flow.

e) The subcontractor will direct and control water in a manner that protects adjacent structures and facilities.

f) The subcontractor will ensure that existing storm drain entering the site from the east is plugged during construction activities until the new storm drain is complete and accepted.

g) The Subcontractor will at all times minimize the creation and emission of dust. The subcontractor will employ means such as water spray and visual observation to control and minimize dust. The source of water for dust suppression will be the TAN fire water system. The Subcontractor shall supply appropriate equipment for water delivery, storage, and application.

WORK IN EXTREME WEATHER:

In the event of extreme storm activity, the subcontractor will provide protective measures to prevent damage to the work by run-on and maintain control of the run-off from the constructed areas. During extreme storm events, the subcontractor will protect slopes by methods approved by the contractor. Prior to re-starting work after an extreme storm event, the subcontractor will inspect and clean out all temporary control structures of debris and sediment buildup, and repair or replace any damaged areas either in the temporary control structures or in the permanent work areas as approved by the contractor.

INSPECTIONS AND REPAIRS:

a) The subcontractor will inspect temporary water control structures and materials on a daily basis and will record inspection findings in the daily work log. The inspection records will be submitted weekly to the contractor.

b) The subcontractor will remove debris and sediment build-up from the temporary control structures as required to maintain the intended flow path.

c) Should overflow or breach conditions be encountered or any other damage observed at the temporary structures, repair and/or replacement of the damaged area will be promptly performed

by the subcontractor.

d) Acceptance criteria for repaired and/or replaced temporary water control structures will be in accordance with the requirements of this specification.

REMOVAL OF TEMPORARY CONTROL MEASURES:

Temporary storm water control measures will be removed once the work has been completed and as directed by the contractor. The subcontractor will properly dispose of the materials removed as directed by the contractor. All areas where temporary control structures are removed will be regraded and revegetated in accordance with Sections 02200 and 02930 of these specifications.

ACCEPTANCE:

The subcontractor will submit a description of any repair or replacement work required to the contractor prior to implementation. Acceptance criteria for repaired or replaced water control measures will be in accordance with the original requirements of this specification.

END OF SECTION 02140

SECTION 02200--EARTHWORK

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

1. Clearing and grubbing as required.
2. Excavating all materials encountered, of every description, for completion of the Subcontract as shown on the drawings and as specified herein.
3. Backfilling of all excavation for TSF-26, and for footings, foundations, pipe and utility trenches, etc.
4. Compacting all backfill and sub-grade as specified herein.
5. Finish grading and grading for surface drainage.

Related Sections:

a) Section 01051 – Construction Surveying and Staking
b) Section 02140 – Temporary Diversion and Control of Water during Construction
c) Section 02430 – Storm Drain
d) Section 02486 – Revegetation

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein.

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (AASHTO)

AASHTO	Standard Specifications for Transportation Materials and Methods of Sampling and Testing
AASHTO M145	Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
AASHTO M288	Standard Specification for Geotextile Specification for Highway Applications
AASHTO T11	Standard Method of Test for Materials Finer Than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
AASHTO T27	Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
AASHTO T99	Standard Method of Test for the Moisture-Density Relations of Soils Using a 5.5 lb Rammer and a 12 in. Drop
AASHTO T238	Standard Method of Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

CODE OF FEDERAL REGULATIONS

29 CFR 1926	OSHA Safety and Health Regulations for Construction, Subpart P
49 CFR 173	DOT Shippers-General Requirements for Shipments and Packagings

US DEPARTMENT OF ENERGY

DOE/ID-01-10381	Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria
DOE/ID-10865	Waste Acceptance Criteria for ICDF Landfill
DOE/ID-10881	ICDF Complex Waste Acceptance Criteria

IDAHO TRANSPORTATION DEPARTMENT (ITD)

SSHC	Standard Specification for Highway Construction

SUBMITTALS:

For approval prior to purchase:

Proposed waste packaging materials, including manufacturer or supplier certification of compliance with the performance requirements of this specification for the following:

1. Liner system
2. Roll-off containers

For approval prior to mobilization:

Excavation plan and schedule, including proposed equipment, excavation sequencing, and schedule.

Work by Others:

The Contractor shall be responsible for handling of all listed wastes once the subcontractor has completed packaging in accordance with the terms of this specification.

PART 2--PRODUCTS

MATERIALS:

Waste Packaging Materials: Waste-packaging materials and procedures shall meet the requirements of DOE/ID 10881 and DOT 49 CFR for IP-1 containers transporting Class 7 materials. Packaging will be supplied by the subcontractor. Appropriate packaging includes but is not limited to 20- and 40-cubic yard roll off containers with liner systems (polyethylene liners, "burrito bags", or Super Sacks). The subcontractor shall ensure that all loads comply with applicable legal weight limits on county, state, INEEL, and Federal roads.

Roll-off containers will be certified decontaminated or uncontaminated by the supplier, and have covers. Labeling materials and procedures shall be in accordance with DOE/ID 10881. All CERCLA waste shall be labeled with a "CERCLA Waste" label that includes an accumulation start date, waste description, applicable codes, and the generating site's name.

General Backfill Satisfactory Soil Materials: Satisfactory soil materials are defined as those complying with AASHTO M145, soil classification Groups A-1, A-2-4, A-2-5.

General Backfill Unsatisfactory Soil Materials: Unsatisfactory soil materials are those defined in AASHTO M145 soil classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also peat and other highly organic soils.

General Backfill and Fill Material: "Satisfactory" soil materials free of rock, gravel larger than 3 in. in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter. Select pit run gravel is available at the TAN gravel pits. Gravel pit material and use of the gravel pits shall be at no material cost to the Subcontractor. Upon completion of operations involving fill material removal, the Subcontractor shall grade and reshape the disturbed areas. Sloped surfaces shall meet the requirements of OSHA 29 CFR 1926. Coordinate gravel pit use with Mike Jackson-526-8872.

Aggregate Base or Leveling Course Material: Naturally or artificially graded mixture of 3/4 in. maximum size crushed gravel, crushed stone, natural and crushed sand. Material shall meet the requirements of ITD SSHC subsection 703.04.

Topsoil: Natural, friable surface soil of organic character suitable for agricultural purposes. Topsoil shall be free of objectionable quantities of subsoil, roots, stones, or other deleterious substances.

Sand Bedding: AASHTO M145, soil classification Group A-3.

Water: Water for use in obtaining optimum moisture content and dust control will be made available from hydrants at TAN.

PART 3--EXECUTION

EXCAVATION:

Clearing and Grubbing: All areas to be excavated shall be stripped and cleared of all brush, weeds, rubbish and organic matter as needed. All vegetable matter, roots, brush and debris encountered during the stripping operations shall be removed from the cleared areas to a depth of at least 4-in. below the subgrade. Stripped material shall be stockpiled or disposed of as specified hereinafter.

Earth Excavation: Earth excavation includes removal and disposal of all material within the limits of the excavation including soil material of any classification, and other materials encountered that are not classified as oversize debris excavation or unauthorized excavation.

Oversize Debris Excavation: Debris excavation consists of removal and disposal of materials encountered requiring use of special equipment. Large tank sections shall be removed and packaged in accordance with the RD/RAWP. Other debris, such as abandoned piping will be packaged for shipment to the ICDF.

Unauthorized Excavation: Unauthorized excavation consists of removal of materials beyond indicated elevations or dimensions without specific direction by the Contractor. Unauthorized excavation, as well as remedial work directed by the Contractor, shall be at the Subcontractor's expense.

Stockpiling and Disposal: Excavated material that is suitable and required for backfilling, grading or topsoil, shall be piled in an orderly manner a sufficient distance from the edge of the excavation, but in no case closer than 2 ft, and so located that it will not interfere with normal vehicular or pedestrian traffic. Excavated materials to be used for backfill shall be kept free from vegetation and other objectionable materials. Topsoil to be used for finish grading shall be kept free from subsoil, vegetation and other objectionable materials and stones larger than 1-in. Excavated materials requiring disposal shall be packaged, labeled, and prepared for transport to ICDF for staging and disposal.

Unstable Soils: If wet or otherwise unsatisfactory soil is encountered in an excavation, at or below the excavation line, it shall be brought to the attention of the Contractor and removed as directed in accordance with Article 38, "Differing Site Conditions", of the General Provisions. The bottom of the excavation shall then be brought to the required grade with concrete or compacted backfill as specified hereinafter. Excavation of unstable soil resulting from the Subcontractor's neglect to keep the excavated opening dry, and other over depth excavation not required to satisfactorily complete the work, shall be brought up to the required grade with concrete or compacted backfill as specified hereinafter at the Subcontractor's expense.

Shoring and Bracing: The sides of all excavations shall be sloped or securely shored and braced in accordance with OSHA 29 CFR 1926, Subpart P. The slopes outlined in the drawings are based on the

Contractor's sampling of two boreholes at the site. The Subcontractor shall be responsible for monitoring conditions at the site and ensuring compliance with OSHA 29 CFR 1926, Subpart P at all times.

Control of Water: All excavations shall be kept free of standing water. The Subcontractor shall control surface water in accordance with section 02140.

HAULING OF EXCAVATED MATERIAL

General: Material shall be loaded into appropriate containers (see Section 2 of this specification) by the subcontractor. The Contractor shall be responsible for securing loads in accordance with the containment manufacturer's written instructions and the project HASP, and transporting the loads to the ICDF. At the ICDF, containers will be unloaded and staged for dumping by the Contractor.

BACKFILL OR FILL:

General: The excavations shall be cleared of all trash and debris prior to backfilling or filling. All backfill or fill material shall be free from trash, organic matter and frozen particles. Backfilling or filling shall be done only when approved by the Contractor. In excavations that are shored, shoring and formwork shall be removed or raised as backfill or fill is placed.

Placement: Concentrated dumping of backfill or fill material into excavations will not be permitted. No water shall be used for placing, settling or compacting backfill or fill except to obtain optimum moisture content. All material must be placed in uniform layers not to exceed 12 in. loose measurement. Loose backfill or fill may be compacted as specified hereinafter.

Compaction of Subgrade: Unless otherwise indicated on the drawings or specifications, compact all backfill and fill material. Unless otherwise indicated, all "compacted" backfill or fill shall be compacted to at least 90% of maximum density at optimum moisture content as determined by AASHTO T99. Unless otherwise noted, loose measurement lifts shall be 12 inches maximum. Each lift shall be compacted before the next lift is placed thereon. Compacted backfill or fill density and moisture content may be measured by the Contractor at any location and depth. Sections of backfill or fill failing to meet the minimum compaction requirements shall be corrected prior to placement of subsequent lifts.

Topsoil Placement: Before placing topsoil, scarify subgrade to a depth of two inches by use of disks or spike tooth harrows. Spread topsoil uniformly and compact to a depth of 6 inches at 85% of maximum density at optimum moisture content.

EQUIPMENT:

Watering Equipment: Provide water tank trucks capable of applying a uniform unbroken spread of water over the surface. A suitable device for positive shut-off and regulation of flow shall be located to permit operation by driver in cab.

FIELD QUALITY CONTROL:

Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 02200

SECTION 02430—STORM DRAIN

PART 1--GENERAL

SUMMARY:
Work shall include furnishing and installing new culverts in accordance with these specifications and the subcontract drawings.

Section Includes: Work includes, but is not limited to:
Furnish and install Corrugated Polyethylene (CPE) storm drains.

Related Sections:
a) Section 01051 – Construction Surveying and Staking
b) Section 02140 – Temporary Diversion of Water during Construction
c) Section 02200 – Earthwork

REFERENCES:
The following documents, including others referenced therein, form a part of this Section to the extent designated herein:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 3350	Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

SUBMITTALS:
Submittals include, but are not limited to the following:

Product Data: Submit product data for pipe which includes installation instructions for approval prior to purchase.

QUALITY CONTROL:
Regulatory Requirements (Codes and Standards): Comply with the following codes and standards, unless otherwise specified herein:

ASTM D 2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 3350	Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

PART 2--PRODUCTS

MATERIALS:
Pipe: The Storm Drain pipe shall be a corrugated outside wall, smooth interior wall high density polyethylene, with HDPE material meeting ASTM D3350, minimum Mannings' N value of .012, and gasketed bell and spigot joints. Hancor Blue Seal or equal.

Gasket: Gaskets shall be watertight according to the requirements of ASTM D3212.
Flared End Sections: Flared end sections shall be supplied for ends as indicated in the drawings. Flared end sections shall be manufactured by the pipe manufacturer and be certified by the manufacturer to be compatible with the pipe size and material to which they are joined.

PART 3--EXECUTION

INSTALLATION:
Location: Install storm drain to lines and grades shown on the drawings.

Earthwork: Excavation, backfilling and grading shall be performed in accordance with Section 02200 Earthwork. Bedding for corrugated polyethylene pipe shall be in accordance with ASTM D2321 standard practice for installing factory-made corrugated polyethylene pipe for sewers and other applications.

Laying Corrugated Polyethylene Pipe: Install pipe in accordance with ASTM D2321 and the manufacturer's printed instructions.

Pipe Testing: Hydrostatic pressure testing shall not be required.

FIELD QUALITY CONTROL:
Surveillance will be performed by Contractor's Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 02430

SECTION 02486--REVEGETATION

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

The subcontractor will furnish all labor, materials, labor, tools, and equipment, and place seed and mulch in accordance with this specification and as indicated on the design drawings. This section describes the subcontractor's requirements to provide a final vegetated surface in those areas designated herein or as shown on the drawings. These designated areas will be seeded and mulched as set forth in this section and on the design drawings.

Related Sections:

a) Section 01051 – Construction Surveying and Staking
b) Section 02220 – Earthwork

Work to be Performed by Others:

The contractor will:

a) Review and approve data submittals as required by this specification
b) Have the option to inspect equipment, work, and materials for compliance with the requirements of this specification, in addition to inspection by the subcontractor
c) Have the option to review preseeding conditions and other related job conditions during performance of the work
d) Perform inspection and acceptance of the final vegetated surfaces.

REFERENCES:

The following documents, including others referenced therein, form part of this Section to the extent designated herein.

United States Department of Agriculture (USDA)
Federal Seed Act

STATE OF IDAHO
Idaho Pure Seed Law, Chapter 4, Title 22, Idaho Code

INEEL Health, Safety and Hazards Prevention Documents
Comprehensive RD/RA Work Plan for the Test Area North OU I-10, Selected Sites.

SUBMITTALS:

Procedures: The subcontractor will submit a Seeding and Mulching Plan to the contractor for written approval within eight working days after notice to proceed. The plan will describe the methods of placement and the equipment to be used during operations.

Certifications: The following certifications are required:

a) The subcontractor will submit eight working days prior to use, the seed vendor's certified statement for the seed mixture required, stating scientific and common names, percentages by weight, and percentages of purity and germination. The Subcontractor will submit a signed

statement certifying that the seed is from a lot that has been tested by a recognized laboratory for seed testing within six months prior to the date of delivery to the construction site.

b) The subcontractor will submit a letter to the contractor verifying conformance to the requirements identified in this specification within four working days after completion of the work specified herein.

c) The Subcontractor shall submit a written warrantee guaranteeing the work for one year from date of acceptance by the contractor.

Records: The subcontractor will submit records of inspection to the contractor within four working days after completion of the inspection.

PART 2--PRODUCTS

MATERIALS:

Seed Mix: Seed will be labeled in accordance with United States Department of Agriculture rules and regulations under the Federal Seed Act and Idaho Pure Seed Law. Seed will be furnished in sealed bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, origin, the percentage weed seed content, the guaranteed percentage of purity and germination, pounds of live seed (PLS) of each seed species, the total pounds of live seed in the container, and the date the of the last germination test that will be within a period of six months prior to commencement of planting operations. Seed will be from a current or previous year's crop. Each variety of seed will meet the requirements of the Idaho Pure Seed Law.

SPECIES	RATE OF APPLICATION (POUNDS PER ACRE PURE LIVE SEED)
"Critanna" Thickspike Wheatgrass, Elymus lanceolatus var critanna	3
"Sodar" Streambank Wheatgrass, Elymus lanceolatus var sodar	3
Rimrock Indian Ricegrass, Achnatharium hymenodes var rimrock	4
Wyoming Big Sagebrush, Artemisia tridentaka ssp. Wyomingensis	1
Winterfat, Ceratoides lanata	2
Total	13

Fertilizer: Fertilizer composition shall be as determined by soil testing the new graded topsoil in four locations as approved by the Contractor. Each component of the fertilizer may vary two percent.

EQUIPMENT:

Seedbed Preparation: Disks, harrows, roller harrow-packers (culti-packers), tooth type harrows, shovels, or other similar equipment.

Seeding and Fertilizing: Drills with double disc and agitator, ground driller hand seeder, culti-packer with seed boxes, Brillion seeder, or other similar equipment.

PART 3--EXECUTION

Season of Work: Seeding shall be done between November 15 and December 15. Specific ideal seeding times within these windows shall be as required for proper seedbed preparation.

Weed Control: Areas to be seeded shall be maintained reasonably free of weeds. The area will be sprayed with an appropriate herbicide that will discourage growth of invasive and noxious weeds.

Seedbed Preparation: Soil shall be tilled a minimum depth of 4 inches**.** The seedbed shall be firm below seeding depth and well-pulverized and loose on top. It shall be free of clods and weeds. Seedbed preparation shall not be performed when soil conditions are not suitable for tilling: too dry, too wet, frozen, etc. Tillage shall produce cross-slope furrows on slopes.

On areas subject to severe erosion, the extent of seedbed preparation shall not exceed that which can be seeded in one day.

Fertilizing: Fertilizing shall closely follow seedbed preparation. Fertilizer shall not be mixed with seed. Fertilizer may be drilled or broadcast. Fertilizer shall be applied as determined by the results of soil testing.

Seeding: Seeding shall closely follow fertilizing. If the seedbed has been disturbed, then the Subcontractor shall prepare the seedbed again. Seeding work shall not proceed until the seedbed has been inspected. Seeds shall be thoroughly mixed prior to application. Seeds shall be uniformly applied at the previously specified rate. Seeds shall be buried 0.25 to 0.75 inches. Seeding shall not be performed when weather conditions are unfavorable: high wind, heavy rain, etc.

Protection: Traffic over seeded area shall be prohibited.

FIELD QUALITY CONTROL:
Seedbed Inspection: Seeding shall not proceed until the Contractor's Representative has inspected the seedbed for conformance to these specifications.

Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 02486

SECTION 03301-- CONCRETE

PART 1--GENERAL

SUMMARY:
Section Includes: Work includes, but is not limited to:
Equipment pad and shield wall.

REFERENCES:
The following documents, including others referenced therein, form part of this Section to the extent designated herein. The ASTM specifications referred to herein are a part of ACI 301.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	Specifications for Structural Concrete for Buildings
ACI 318	Building Code Requirements for Reinforced Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 615	Standard Specification for Deformed and Plain Billet-Steel Bar for Concrete Reinforcement
ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C 150	Standard Specification for Portland Cement
ASTM C 260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

SUBMITTALS:
Submittals include, but are not limited to the following:

Mix Design: Submit mix designs for concrete used.

Batch Tickets: Supply a copy of the batch ticket with each load of concrete.

QUALITY CONTROL:
Comply with provisions of ACI 301 unless otherwise specified herein.

PART 2--PRODUCTS

FORM MATERIALS:
Forms for Concrete: Furnish in largest practicable sizes to minimize number of joints. Comply with applicable provisions of ACI 301.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

REINFORCING MATERIALS:
Reinforcing Bars: ASTM A 615, Grade 40, deformed, as indicated on the drawings.

Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing in place.

CONCRETE MATERIALS:
Portland Cement: Cement shall conform to ASTM C 150, Type I-II. The cement shall contain no more than 0.60% by weight of alkalies calculated as ($Na_2O + 0.658\ K_2O$).

Pozzolans: Pozzolans (fly ash) shall conform to ASTM C 618 Class F, except that the loss on ignition (LOI) shall be less than 2%.

Aggregate: Fine and coarse aggregate shall conform to ASTM C 33.

Mixing Water: Potable having no pronounced taste or odor, and containing no deleterious materials.

Air-Entraining Agents (AEA): ASTM C 260.

Water-Reducing Admixtures: If water-reducing admixtures are used they shall conform to ASTM C 494, Type A, and contain no more than 1% chloride ions.

Calcium Chloride: Calcium chloride is not permitted.

RELATED MATERIALS:
Curing Compound: Curing compound or curing-hardener-sealer compound shall comply with ASTM C 309, Type I, Class A.

The compound shall be compatible with adhesives or paints if it is to be applied in areas to receive paint or floor covering requiring adhesives.

PROPORTIONING AND DESIGN OF MIXES:
Mix Design: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318.

Design mixes to provide normal weight concrete with the following specified 28-day compressive strengths, minimum, as indicated on drawings and schedules:

Class 40: 4000 psi (structural concrete)

See ACI 301, Chapter 17 for acceptance criteria.

The concrete mix may contain a pozzolan (fly ash). When fly ash is used, the minimum amount shall be 15% by weight of the total cementitious materials unless otherwise approved.

Durability: Concrete shall be air-entrained and shall have a minimum 28-day compressive strength of 4,000 psi and a maximum water-cement ratio of 0.45. Add air entraining agent (AEA) at the manufacturer's prescribed rate to result in concrete at point of placement having air content complying with ACI 301.

MIXING AND DELIVERY:
The manufacture and delivery of all concrete shall conform to ACI 301.

Concrete that is rejected for failure to meet any of the above requirements will be evaluated by the Contractor and may be removed and replaced at the expense of the Subcontractor.

SOURCE QUALITY CONTROL:
The Subcontractor shall provide the necessary testing and monitoring to qualify proposed materials and establish mix designs.

PART 3--EXECUTION

FORMS:
Comply with ACI 301.

PLACING REINFORCEMENT:
Comply with ACI 301.

Splicing of reinforcement shall be in accordance with ACI 318, Chapters 7 and 12. All splices shall be Class B tension splices for regular bars.

JOINTS:
No joints shall be permitted.

CONCRETE PLACEMENT:
Comply with ACI 301.

FINISH OF FORMED SURFACES:
Strike off smooth with top of form

CONCRETE CURING AND PROTECTION:
Comply with ACI 301.

REMOVAL OF FORMS:
Comply with ACI 301.

CONCRETE SURFACE REPAIRS:
Comply with ACI 301.

FIELD QUALITY CONTROL:
Subcontractor Supplied Testing: The Subcontractor shall provide the necessary testing and monitoring services for the following:

Testing services needed by the Subcontractor to control or monitor the production, transportation, placement, protection, curing or temperature of the concrete.

The use of Contractor supplied inspection or testing services shall in no way relieve the Subcontractor of the responsibility to furnish materials and construction in full compliance with the subcontract documents.

Contractor Supplied Testing: The Contractor's Representative will perform tests during placement and curing of the concrete. Monitoring of concrete protection and curing methods may also occur.

Sampling and testing for quality control during placement of concrete may include any of the tests specified in ACI 301 1.6.

END OF SECTION 03301

SECTION 13121 – VACUUM SYSTEM

PART 1--GENERAL

SUMMARY:

The Subcontractor shall design, assemble, test, and provide technical support for one vacuum system which includes:

- power pack
- multi-media filter
- knockdown hopper
- on-board air compressor
- frame
- hoses

As well as ancillary equipment, including:

- stainless steel rotary airlock flange/coupling adapter
- 12" diameter reinforced neoprene flexible coupling as required by this specification.

The system shall be designed to extract dry or moist, crumbly waste mixture from the PM-2A tanks, separate solids (collected in a batch hopper) from dust-laden air (filtered down-stream), and deposited through a flanged seal into a DOT 7A Type A standard waste box. The entire vacuum system shall be constructed so as to facilitate relocation and setup, such as modular skid-mounting and permanently attached lifting points. Subcontractor shall identify and supply recommended spare parts.

Section Includes: Work includes, but is not limited to:

Design, assemble, test, and provide technical support for one vacuum system (complete with knockdown hopper and related equipment), rotary airlock flange/coupling adapter, and 12" diameter reinforced neoprene flexible coupling. Provide warranty and submittals as specified below.

Related Sections:

Section 01005, General
Section 13124, DOT 7A Type A Waste Boxes
Section 13400, Instruments and Equipment
Section 15404, Piping and Plumbing
Section 15810, Ventilation
Section 15883, HEPA Filter Housing

Performance Warranty:

Performance of the vacuum system shall be demonstrated using surrogate material testing for the bulk density and makeup of the tanks' contents (information to be provided by BBWI). Provide documentation to ensure appropriate vacuum and flow rates (approximate bulk density of sludge is 80 lb/ft^3) may be achieved.

Equipment Warranty: Subcontractor shall supply as part of proposal package a copy of Equipment warranty documenting formal warranty coverage for at least one (1) year from date of shipment.

REFERENCES: All equipment provided and the installation of the system shall comply with the applicable sections of the following codes and standards:

ASTM A500 Series Structural steel standards

SUBMITTALS:
Unless otherwise stated, submittals shall be made prior to construction start. Additional submittal requirements may be found in the VDS.

Submittals for approval:
Subcontractor shall submit and obtain contractor approval of detailed drawings, calculations, proposed vacuum system, model selected, equipment warranty, principal dimensions, and details of construction per the VDS. The proposal package shall be approved prior to purchase.

A vacuum system detailed design package shall be provided prior to delivery and will include:
- Diagram of vacuum system
- Cut sheets for all equipment
- Assembly and fabrication drawings, which are to include:
  - Principal components, dimensions and details of construction
  - Equipment layout drawings
  - Sizes and locations of hose connections
  - Support anchoring system, including grouted or cast-in anchors, if required

Functional and operational testing procedures shall be submitted and approved prior to use (see Part 3 for additional testing requirements).

Submittals for information:
- Installation instructions (before final acceptance)
- Operation and maintenance manual (2 weeks prior to the start of operational testing)
- System operating Procedure

Submittals for project closeout:
- Functional and operational testing results

QUALITY CONTROL:
Qualifications: Vacuum system shall be furnished by a firm qualified, accredited, and regularly engaged in manufacture of diesel-powered hopper collected vacuum systems, and shall maintain shop and facilities for fabrication and maintenance of subject equipment.

Items of Any One Classification: Items that are used in quantity, such as valves, specialties, accessories, fittings, etc., shall in each case be the product of one manufacturer, and shall be used only for the services recommended by the manufacturer.

PART 2--PRODUCTS

GENERAL:
The vacuum system frame shall be designed to meet ASTM standards for structural steel and constructed so as to facilitate relocation and setup, such as modular skid-mounting. All design calculations and drawings are to be prepared under the supervision of a registered Professional Engineer. PE stamps shall be included on all calculations and drawings submitted. The subcontractor shall identify and supply recommended replacement parts.

MATERIALS:
Vacuum system: Vacuum system shall include a diesel-powered, water cooled industrial vacuum powerpack, multimedia filter module, and support structure.

Diesel-powered, water cooled industrial vacuum as manufactured by Multi-Vac, Inc. (or approved equal):

- minimum 100 hp diesel rating
- 75hp engine to provide at least 1500 cfm at 16" Hg
- minimum 50 gallon fuel tank
- vacuum pump noise abatement
- integral steel base with fork lift tubes to accommodate engine, vacuum dump, silencer, and fuel tank
- base not to exceed 48" wide x 86" long x 60" high
- integral controls, remotely accessible via radio frequency, for vacuum start, stop, offline manual filter cleaning, high level control, variable speed selection, automatic on-line pulse filter cleaning
- 8000 watt generator to power rotary airlock
- on-board air compressor to supply 85-100 psi compressed air to reverse pulse system.

Multimedia filter module as manufactured by Multi-Vac, Inc. (or approved equal):

- minimum 60 ft^3 rotary air lock hopper with 12" x 12" square discharge flange (bolt pattern to match rotary airlock/coupling adapter), and solids knockdown deflectors
- multimedia filter receiver after solids knockdown for dust-laden air
- air to cloth ratio in excess of 6:1
- fully automatic reverse pulse jet multimedia filter cleaning (during operation of vacuum), air to be supplied by on-board air compressor.
- Reverse pulse jets shall also have a manual blast available
- high level and low level probe, volume between probes set to 60 to 65 ft^3 with hopper full indicator light and automatic vacuum shut off connected to high level indictor (vacuum shall be disabled while high level is active)

- vacuum relief valve

- quick access to filters and bag cages, minimum changeout time of filters and bag cages.

Hose and accessories:

- 3 each, 100' of 5" smooth interior rubber hose, with camlock ends (includes 2 spare hoses)

- 2 each, 10' of 3" smooth interior rubber hose, with camlock ends (includes 1 spare hose)

- 3 each, 10' of 5" smooth interior rubber hose, with camlock ends (includes 2 spare hoses)

- 3 each, 6' long 5" smooth interior wand with 2" conical nozzle and 5" camlock connection for debris removal (includes 2 spare wands)

- 3 each, 6' long 5" smooth interior wand with 2" tapered flat nozzle and 5" camlock connection for debris removal in corners (includes 2 spare wands)

- stainless steel rotary airlock/coupling adapter, 12" tall 12" diameter tube transitioned into 12" square flange in 3" height

- 12" diameter reinforced neoprene flexible coupling, length to match installed height of rotary airlock/coupling adapter and recessed waste box coupling adapter including 2" sleeve ends with a T-clamp on one end and a levered clamp (handle to be no longer than 2") on the other.

- HEPA filter housing per section 15883.

Vacuum frame:

- shall be constructed of 4" steel tubular frame

- bottom of frame shall extend 6" beyond the bottom of the rotary airlock

- installed to facilitate replacement of full waste boxes

- mounted so as to prevent lateral load failure.

PART 3--EXECUTION

GENERAL INSTALLATION OF ALL SYSTEMS:

Vacuum system handling/installation shall follow procedures specified in INEEL standards and shall be set in place, aligned, assembled plumb and level, and made ready for operation

Integrated Testing: Component checkout testing of assembled unit shall be conducted at design flowrate to confirm proper vacuum and leak-free airborne performance of basic system and all accessories by the manufacturer at the vendor's site. Integrated testing shall be completed at the INEEL after full installation is completed.

Accessibility: Items such as valves, controls, and accessories shall be placed so as to be readily accessible for operation, servicing, maintaining, and repairing. Indicating instruments shall be placed for

easy reading from operating floors or platforms. If indicating instruments are 6 ft or more above floors or platforms, set at 45° angle.

EQUIPMENT, FIXTURES, ETC.:
Equipment shall be set in place, aligned, connected per the applicable drawing, and made ready for operation. Connections and required safety devices shall be installed. Initial lubrication shall be provided. Controls shall be placed in the most favorable ergonomical position and shall be set for efficient, stable operation.

Instrumentation support fixtures shall be assembled and supported per the applicable drawings in a safe, rigid, neat, and orderly manner. They shall be free from undue stresses and made suitable for normal use.

All of the above shall be protected from damage during and after assembly. At completion, work shall be free from tool marks, cracks, scratches, chips, and other defects.

FIELD QUALITY CONTROL:
Contractor Inspections: Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

ATTACHMENTS:
None

END OF SECTION 13121

Project Title:	**WAG 1, Operable Unit 1-10, Group 3, TSF-26 PM-2A Tanks Remedial Design**		
Document Type:	**Construction Specifications**	**Project Number:**	**23095**
SPC Number:	**475**	**Revision Number:**	**0**

SECTION 13124 – DOT 7A TYPE A WASTE BOXES

PART 1--GENERAL

SUMMARY:
The Subcontractor shall furnish a specified number of DOT 7A Type A standard waste boxes as required by this specification and attached drawings. One additional DOT 7A certified Type A lid for each box shall be supplied, designed to bolt to the box and connect through an integral, recessed coupling adapter to the vacuum system. The waste boxes shall be able to be lifted both by fork lift trucks and crane .

Section Includes: Work includes, but is not limited to:

Furnish a specified number of DOT 7A Type A standard waste boxes and DOT 7A certified Type A modified waste box lid as required by this specification and attached drawings. Warranty and submittal requirements are specified below.

Related Sections:

Section 01005, General
Section 13121, Vacuum System
Section 13400, Instruments and Equipment

Performance Warranty:

Performance of the waste boxes shall be guaranteed based on Vendor's testing and calculations for DOT 7A Type A leak and drop criteria. Provide complete documentation of tests and an engineering evaluation of comparative data showing that the construction methods packaging design and materials of construction comply with DOT Specification 7A (49CFR 178.350). Additionally, box seal must have a design life of at least 2 years.

Equipment Warranty: Vendor shall supply as part of proposal package a copy of Equipment warranty documenting formal warranty coverage for at least one (1) year from date of shipment.

REFERENCES: All equipment provided shall comply with the applicable sections of the following codes and standards:

49CFR173 & 178	Code of Federal Regulations
PLN-120, Table 1	Hazardous material packaging and transportation quality implementation plan

SUBMITTALS:
Unless otherwise stated, submittals shall be made prior to construction start.

Submittals for review:
Subcontractor shall submit and obtain contractor approval of calculations, equipment warranty, and design package prior to purchase.

Certificates of Conformance

A waste box design package shall include

Diagram of waste box
Cut sheets

Shop drawings, which include Sizes and locations of all appurtenances of modified lid

QUALITY CONTROL:
Qualifications: Waste boxes shall be furnished by a firm qualified, accredited, and regularly engaged in manufacture of DOT 7A waste boxes, and shall maintain shop and facilities for fabrication and maintenance of subject equipment.

Items of Any One Classification: Items that are used in quantity, such as specialties, bolts, washers, etc., shall in each case be the product of one manufacturer, and shall be used only for the services recommended by the manufacturer.

PART 2--PRODUCTS

GENERAL:
The waste boxes shall be designed to meet DOT 7A standards for Type A waste containers. PE stamps shall be included on all calculations and drawings submitted.

MATERIALS:

Waste boxes as manufactured by *Capital Industries, Inc.* (or approved equal):

- nominal dimensions of 4' wide x 6' long x 4' high
- a maximum approved gross weight of at least 10,000 pounds and a maximum approved net weight of at least 8,000 pounds (weight of empty box no more than 2,000 pounds)
- access points for lifting with fork lift trucks
- crane lifting points attached to lid (for removal of lid)
- crane lifting points attached to the box (for lifting of waste box).

Modified lids shall be DOT 7A certified Type A and include:

- one integral 12" diameter coupling adapter approximately centered in the lid and recessed 3" below top of lid. The lid shall include a cap (blank plate) with gasket for sealing that utilizes a sealing bolt pattern similar to overall lid sealing bolt pattern (distance between bolts shall be no more than 4"). The center of the 12" adapter shall be approximately centered lengthwise in the lid (± 6").
- two 2" diameter recessed passive HEPA filters at approximately ¼ and ¾ the length of the lid (so as to be located between reinforcing ribs); include a flush sealing plug with a recessed tool entry for plug manipulation
- One 3" diameter sampling port at approximately ¾ the length (so as to be located between reinforcing ribs); include a flush sealing plug with a recessed tool entry for plug manipulation
- include crane lifting lugs.

PART 3--EXECUTION

All of the above shall be protected from damage during and after shipping. At delivery, work shall be free from tool marks, cracks, scratches, chips, and other defects.

FIELD QUALITY CONTROL:

Contractor Inspections: Surveillance may be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

ATTACHMENTS:

Drawing M-13
Drawing M-14
PLN-120, Table 1
VDS

END OF SECTION 13124

SECTION 13130 – DE DELIVERY SYSTEM

PART 1 – GENERAL

SUMMARY:
The subcontractor shall furnish and supply technical support for one DE (diatomaceous earth) pressure transfer system (including skid assembly, pressure blower, bag dump station, rotary airlock, product flex hose, bin vent, and auger feeder) as required by this specification. The system shall be designed to accept DE at the bag dump station, transfer to the bin vent, and feed to the PM-2A waste tank on demand.

Section Includes: Work includes but is not limited to:
Furnish and supply technical support for one DE pressure transfer system as described herein.
Provide warranty and submittals as specified below.

Related Sections:
Section 01005, General

Performance Warranty: Performance of the DE delivery system shall be guaranteed to deliver DE using dilute phase pneumatic transport based on bulk density of 16lbs/ft^3. Conveying rate shall be guaranteed up to 200lbs/min. (12.5ft^3/min.) at the bag-dump station. Screw conveying rates may be lower to accommodate smaller conveyor equipment at the bin vent.

Equipment Warranty: Vendor shall supply as part of proposal package a copy of equipment warranty documenting formal warranty coverage for at least one (1) year from date of shipment.

SUBMITTALS:
Unless otherwise stated, submittals shall be made prior to construction start.

Submittals for review: Vendor approval: Subcontractor shall submit and obtain contractor approval of calculations, proposed pneumatic transport system, equipment warranty, principal dimensions, and details of construction prior to purchase and submittal of other required vendor data. The vendor's proposal package shall be approved prior to purchase. System shall be as manufactured by *Industrial Accessories Company (IAC)*, Mission, KS (or approved equal).

A DE delivery system design package shall be provided prior to delivery and shall include:
Diagram of material flow path
Vendor cut sheets for all equipment
Shop drawings including:
- Principal dimensions and details of construction
- Equipment layout drawings
- Sizes and locations of hose connections
- Mounting skid and bin vent cart

Operational testing procedures shall be submitted and approved prior to use.

Submittals for information:
- Installation instructions
- Operation and maintenance manual
- Operating procedure

Submittals for project closeout:
Operational testing results

QUALITY CONTROL:
Qualifications: The DE delivery system shall be furnished by a firm qualified, accredited, and regularly engaged in manufacture of these types of systems, and shall maintain shop facilities for fabrication and maintenance of subject equipment.

Items of Any One Classification: Items that are used in quantity, such as valves, specialties, accessories, fittings, etc., shall be in each case the product of one manufacturer, and shall be used only for the services recommended by the manufacturer.

PART 2 – PRODUCTS

GENERAL:
The DE delivery system skid and bin vent cart shall be designed to meet ASTM standards for structural steel. All design calculations and drawings are to be prepared under the supervision of a registered professional engineer. PE stamps are to be provided on all drawings and design calculations.

MATERIALS:
DE delivery system: The DE delivery system shall use dilute phase pneumatic transport between the bag dump station and the bin vent. Power to drive the blower, airlock valves and feed auger shall be provided by a diesel generator mounted with the bag dump station.

Skid assembly: The system skid shall be of carbon steel construction and built to support the blower, bag dump station, and power supply control panel. Lift anchors and forklift slots shall be provided for transport.

Pressure blower package: The blower shall be a roots type positive displacement blower sized to provide 3.5psi at 385cfm. A relief valve shall be provided on the exhaust set to 10psia. Intake and exhaust ports shall utilize silencers for noise reduction and the intake shall be filtered to prolong blower service life. A pressure gauge shall be provided to the exhaust for monitoring performance and be mounted on a vibration-free surface. Recommended IAC part number is V56-20-3T-HS.

Bag dump station: The bag dump station shall consist of a hopper, bag break, and weather cover. Total product capacity shall be at least 5 ft^3. The bottom of the hopper shall be flanged to mate to the rotary airlock.

Rotary airlock assembly: The rotary airlock shall be an 8 vane, 1hp unit. It shall be potentiostatically controlled to provide variable feed flow. Recommended IAC part number is HE-12-8-1 HP.

Blow through adapter: A blow through adapter shall be provided under the airlock assembly. The adapter shall be flanged to the airlock and have 3" inlet for the blower and 3" male cam-lock quick release for the exhaust.

Product flex hose: 75' of 3" Flex hose shall be provided to convey product to the bin vent. The hose shall use 3" female cam-lock hose adapters to connect between the blow through adapter and bin vent or optional discharge nozzle.

Bin vent: The bin vent shall be a bottom load pulse-jet filter. The air-to-cloth ratio will be 4.14/1 sized to 385cfm. Filter media will be selected to operate at 20"H_2O. Recommended IAC part number is 36TB-BVI-16:S6 style 2. Immediately below the bin vent shall be a hopper into which the primary transport line enters. This hopper will also adapt the bin vent flange to the gate valve flange with a small storage volume underneath the transport line entry.

Gate valve: The gate valve shall be provided for isolation between the feed auger and bin vent. The gate valve shall be pneumatically controlled. Recommended part number is SA08-MG-RS from Salina Vortex Corporation. The gate valve shall include a special service inlet designed for handling abrasives, an air control assembly, and the necessary electrical accessories for operation.

Screw conveyor: A screw conveyor shall be provided that dispenses the product from the bin vent to the PM-2A waste tank. The conveyor shall be 8' long and powered with an electric drive motor. The conveyor shall be inclined 35 degrees to clear the tank cover cart. WAM Inc. is the recommended vendor for the screw conveyor. A 9" unit capable of 409cfh is recommended.

Bin vent support structure: A support structure shall be provided with the bin vent that allows easy movement about the tank cleanup area. The support structure shall hold the bin vent, sliding gate valve, and feed auger. Adequate height shall be built into the structure that the lowest portion will clear at least 8" of tank-side structure.

I/O box: Controls and service lines shall be based in an I/O box on the feed skid. The controls shall regulate power on/off, pneumatic air pressure, feed rates, bin vent filter pulse, and gate valve operation. The rotary airlock and feed auger shall be potentiostatically controlled in parallel to ensure equal feed rates at both ends of the system. The gate valve shall be open at any time the auger is turning. A defeat shall be built in to run the feed auger or rotary airlock independently. Power and control lines to support the bin vent shall be bundled and manifolded at the I/O box with a single umbilical to the bin vent. A switch panel shall be tethered to the I/O box to allow complete operation of the unit at a distance of 20 feet. All service lines including electric power and pressurized air will connect at the I/O box.

PART 3 – EXECUTION:

GENERAL INSTALLATION OF ALL SYSTEMS:
DE delivery system handling and operation shall follow procedures specified in INEEL standards and vendor operating instructions. The DE delivery system shall be set in place, and made ready for operation. DE shall be staged next to the bag dump station for easy access by system operators.

Accessibility: Forklift access shall be maintained to the DE staging area for retrieval and replacement of DE pallets.

EQUIPMENT, FIXTURES, ETC.:
Equipment shall be set in place, aligned, and connected per the applicable drawings and made ready for operation. Connections and required safety devices shall be installed. Initial lubrication shall be provided. Controls shall be set for efficient and stable operation.

Feed skid I/O box: The feed skid shall be provided with 460V/3P/60Hz and 120V/1P/60Hz electric power supply and 10scfm @ 90-100psi clean dry air to power and control the various parts. These supplies will all enter the I/O box on the feed skid.

FIELD QUALITY CONTROL:
Contractor inspections: None

ATTACHMENTS:
None

END OF SECTION 13130

SECTION 13400--INSTRUMENTS AND EQUIPMENT

PART 1--GENERAL

WORK DESCRIPTION:
The Subcontractor shall provide all instrumentation and controls, as specified below and in the design drawings for the OU 1-10 remediation and ensure that all performance requirements are met.

Section Includes:
The Subcontractor shall provide the following instrumentation and controls for the OU 1-10 remediation including, but not limited to:

1. Flow meter (FI-101)
2. Pressure indicators (PI-101 and PI-104)
3. Vacuum relief valve (PRV-101).

RELATED SECTIONS:
Section 01005 – General

SYSTEM DESCRIPTION:
General Design Requirements: A description of the design and performance requirements for the instrumentation equipment is contained in the specified attachments.

QUALITY CONTROL:
Codes and Standards: The following standards and criteria (latest edition) shall be used, where applicable, in the design of the building covered by this specification.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5-88/B16.5A-92 "Pipe Flanges and Flanged Fittings"

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A105/A105M-96 "Standard Specification for Carbon Steel Forgings for Piping Applications"

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70-96 National Electrical Code, 1996 Edition

NATIONAL ELECTRIC MANUFACTURING ASSOCIATION (NEMA)

NEMA ICS 6-93 Enclosures for Industrial Control and Systems; Revision 1 - March 1989

General:
Instrumentation equipment shall be new, industrial type, and of the function and type specified in Part 2.

Instrumentation equipment provided shall be compatible with the intended service. Instrument equipment shall be calibrated to the manufacturer's standards. Test equipment shall be calibrated and shall be traceable by tag number, make, and model number.

Manufacturers' Qualifications: Manufacturers shall have 5 years of verifiable experience in the production of instrumentation equipment of the same type and similar performance as that specified herein.

Instrument equipment shall be calibrated in accordance with the manufacturer's recommendations.

SUBMITTALS:
Submittals for Review:
Product Data: Provide catalog "cut sheets," data sheets, wiring diagrams, and flow characteristic curves prior to procurement.

Submittals for Information: Installation instructions, including recommended calibration procedures and installation details. Include frequency of calibration required at the time after system installation and regular intervals of time thereafter.

Submittals at Project Closeout: Provide operations and maintenance (O&M) manuals.

Submit manufacturer's warranties for all applicable instruments and equipment.

DELIVERY, STORAGE, HANDLING, AND SHIPPING:
Product shipping container(s) shall contain packing materials to prevent the entrance of water to instrument surfaces, interior, and exterior. Product shipping container(s) shall be clearly marked "FRAGILE - DO NOT DROP," and shall be furnished with an itemized invoice stating the contents and quantity of products contained therein.

PROJECT CONDITIONS:
The INEEL is located near Idaho Falls, Idaho—approximately 4,900 ft above sea level. Ambient temperature range is from 20 to 120°F, with a barometric pressure of approximately 29.0 in. Hg absolute (mean at 70°F). Relative humidity varies from 20 to 100%.

MAINTENANCE:
The Subcontractor must provide any extra/replacement parts or materials required to maintain acceptable product performance up to the time in which acceptance testing is complete.

PART 2--PRODUCTS

INSTRUMENTATION:
Flow Meter (See Attachment A.)
Flow meter will consist of an in-line flow sensor and flow indicator. The flow sensor shall be a pitot tube type for air flow in the discharge line after the HEPA filters. The pitot tube flow sensor will have a matched magnahelic differential pressure gage flow indicator mounted in the vicinity of the flow sensor and shall display flow rate on the 2SSQRT scaled display. Scale shall be in cubic feet per minute (CFM).

Pressure Gauges (See Attachment A.)
Gage type shall be magnahelic differential pressure. Elements in contact with the process shall be manufactured from material suitable for the PM-2A waste makeup. Gauge shall have a 4-in. dial, 1/8-in.

NPT connection. All gauges shall be vibration and shock resistant. Scale shall be selected so that normal operating range is between 33 and 67% of span.

Vacuum Relief Valve:
Relief valve shall be a 3" one-piece body. At least 900 SCFM flowrate shall be supported. Set point shall be no less than 12" Hg and no more than 14" Hg.

PART 3--EXECUTION

CLEANING:
Instruments shall be cleaned in accordance with the manufacturer's recommended cleaning procedures. After cleaning, work shall be free from contamination with no residual contaminants present that could cause the instrument to become inoperative, no residual moisture present, and no corrosion products (such as rust) present.

ATTACHMENTS:

ATTACHMENT A:
The following data sheets are attached:
1. Flow meter
2. Pressure gauges (2), Dwyer, or equal

Attachment A

REQUISITION NO.			VENDOR: Dwyer			
1	Loop Tag No.		PI 101	PI 104		FI 101
2	Item No.		PI 101	PI 104		FI 101
3	Manufacturer/Model NO.		Dwyer 2210	Dwyer 2210		Dwyer 2SQRT with DS-300-6
4	Service		Air, 85°F	Air, 85°F		Air, 85°F
5	Line No.		Main vacuum line inlet	Main vacuum line outlet		Main outlet
6	P&ID No./Section					
SERVICE CONDITIONS						
7	Fluid		Air	Air		Air
8	Normal Flow (CFM)		500-1500	500-1500		500-1500
9	Flow (CFM) Max/Min		1550 / 500	1550 / 500		1550 / 500
10	Temperature Max/Min (°F)		100 / 50	100 / 50		100 / 50
11	Pressure Max/Min (psig)		7.8 / 0	7.8 / 0		7.8 / 0
12	Velocity Max/Min (ft/sec)					131 / 42
13	Conductivity Norm/Min					
14	Specific Gravity Max/Norm					
15	% Solids Max/Norm					
16	Extra Conditions or Req.					
17	Tube Size (in.)		5”	6”		6”
18	Liner Material					
19	End Connections Type/Mat.		1/8” NPT	1/8” NPT		1/8” NPT
20	Electrode Material					
21	Meter Casing		Aluminum	Aluminum		
22	Power Req.					
23	Enclosure Case		Aluminum	Aluminum		
24	Grounding Type/Mat.					
25	Ultrasonic Cleaning					
26	Extra Features/Req.					
TRANSMITTER (Tag No.)						
27	Output Signal					
28	Calibrated Flow Range (psi)					
29	Conduit Conn. Size					
30	Mounting					
31	Enclosure Class					
32	Signal Cable Length					
33	Power Requirements/Code					

34	Integrator					
35	Zero Return					
36	Alarms					
37	Special Modification					
38	Extra Features/Req.					
Notes:						

1
2

REQUISITION NO.					VENDOR: DWYER			
Reference Specification Sheet No.					Model No.			
1	Type:	☒ Indicating ☐Other	☐ Receiver		8	Pressure Element:	☐ Bourdon ☐Other	☐ Bellows
2	Mounting:	☐Surface	☐Local	☐Flush	9	Element Material:	☐Bronze	☐Steel
3	Dial Diam:	4”				Type:	☐ Stainless	☐Other
4	Dial Color:	☐Black	☐White		10	Socket Material:	☐Bronze	☐Steel
5	Case Material:	☐Cast Iron ☐Other	☐ Aluminum	☐Phenol		Type:	☐ Stainless	☐Other
6	Ring Type:	☐ Screwed ☐Other	☐Hinged	☐Slip	11	Connection – NPT	☐1/4 ☐Bottom	☐1/2 ☐Back
7	Liquid Filled:	☐ Glycerine ☐Other			12	Movement:	☐Bronze ☐Nylon	☐Other
					13	Blowout Disk:	☐Yes	☐No

Rev	Tag No.	Item No.	P&ID No. & Section	Range		Operating Pressure	Service	Accessories
				Tube	Dial			
	PI 101	2210			0-10	0-7.8	Air, ambient temp.	
	PI-104	2210			0-10	0-7.8	Air, ambient temp.	
Notes:								

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END OF SECTION 13400

SECTION 15025—STEEL STRUCTURAL WELDING

PART 1--GENERAL

WORK DESCRIPTION:
The Subcontractor shall furnish all labor, materials, equipment, and services necessary to perform all structural welding required in accordance with the Subcontract drawings and the following specifications.

Design, testing, inspection, filler materials, and workmanship requirements shall conform to the appropriate code.

WORK INCLUDED: Work includes, but is not limited to:

- Structural welding
- Torch cutting carbon steel tanks and ribs
- Pipe support welding
- Stainless steel pipe cap welding

RELATED SECTIONS:

- Section 01005 – Summary of Work
- Section 15404 – Piping and Plumbing.

REFERENCES:
Codes and Standards: Comply with requirements of the current revision of the following codes and standards, as specified in this specification:

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC (ASD)	"Specification for Structural Steel Buildings - Allowable Stress Design (ASD) and Plastic Design"

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z49.1	"Safety in Welding and Cutting"

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT SNT-TC-1A	"Personnel Qualifications and Certification in Nondestructive Testing"

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	"Symbols for Welding and Nondestructive Testing"
AWS A3.0	"Welding Terms and Definitions"
AWS D1.1	"Structural Welding Code-Steel"
AWS QCI	"AWS Standard for Qualification and Certification of Welding Inspectors"

IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY (INEEL)

INEEL Welding Manual

DEFINITIONS AND SYMBOLS:
Definitions for welding terms shall be in accordance with AWS A3. Weld symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

SUBMITTALS:
Unless otherwise noted, all submittals shall be made prior to construction start.

Submittals for Review:
1. Handling, storage, and control procedures for filler materials and backing material.
2. Welding procedure specifications and procedure qualification records. These procedures shall be referenced on the shop drawings, erection drawings, and subcontract drawings as applicable.
3. Detailed weld repair procedures.
4. Subcontractor's nondestructive examination procedures.
5. Shop drawings for building structural welding shall show all welds, size, preparation, etc. The drawings shall differentiate between shop and field welds. The weld procedures and filler material to be used shall be indicated.

Submittals for Information:
1. Welding personnel qualification records
2. Subcontractor's nondestructive examination personnel qualification records
3. Certificates of conformance for weld filler materials.

Submittals for Project Closeout:
1. Weld Reports
2. Weld repair reports.

QUALITY CONTROL:
Codes and Standards Regulatory Requirements (Codes and Standards): Comply with provisions of the following codes and standards, unless otherwise specified herein:

AISC ASD Specification
AWS D1.1
AWS D1.3

General:
Components with welds will not be accepted unless the welding has been specified or indicated in the design documents or otherwise approved. Welding shall be as specified in this Section except where additional requirements are indicated or are specified in other sections.

Weld Procedure Qualification:
Off-Site Procedures: The Subcontractor shall establish and qualify Weld Procedure Specifications (WPS) for any off-site welding performed during this Subcontract in accordance with the requirements of AWS B2.1, D1.1 or D1.3 as applicable. Approval will not relieve the Subcontractor of the sole responsibility for preparing procedures in accordance with the above referenced specification.

The Subcontractor may use welding procedures from the INEEL Welding Manual listed in PART 3 Welding Processes paragraph for off-site welding if a letter is submitted as vendor data stating that these procedures are being adopted for use in performance of this subcontract.

On-Site Procedures: Welding procedures from the INEEL Welding Manual listed in PART 3 Welding Processes paragraph shall be used for on-site welding.

Welder Qualification:

Off-Site: Off-Site welding shall be performed by welders or operators qualified in accordance with the requirements of AWS B2.1, D1.1 or D1.3 as applicable for structural and pipe support welding. Welders or welding operators qualified to *INEEL Welding Manual* procedures can be used for off-Site welding if the applicable INEEL weld procedures are identified and submitted as vendor data. When using *INEEL Welding Manual* procedures for off-Site welding, welders shall be qualified at the INEEL Welder Test Facility.

On-Site: All on-Site welding performed under this specification shall be performed by welders or welding operators qualified at the INEEL Welder Test Facility using the applicable procedures specified from the *INEEL Welding Manual*.

Certification: Upon successful completion of the qualification test, the welder shall be provided with a certificate card by the Subcontractor (off-Site) or in compliance with the *INEEL Welding Manual* (on-Site). The certificate shall state the welding process, codes, and procedures under which the welder is qualified, and the name of the individual who issued the certificate. The welder shall carry the certificate card when performing welding under this contract. The Subcontractor shall have on file documentation, affidavits, and records of testing and test results that qualified the welder for certification. These records shall be certified by the Subcontractor and shall be submitted to the Contractor as vendor data.

Renewal of Qualification: Renewal of qualifications for a welder or welding operator working on-Site shall be in accordance with the *INEEL Welding Manual*. Renewal of qualifications of a welder or welding operator working off-Site shall be as required in AWS D1.1 or D1.3 as applicable.

Nondestructive Examination Procedures: The Subcontractor shall establish detailed inspection procedures and acceptance criteria for each nondestructive examination required in accordance with the requirements specified in PART 3 EXECUTION – FIELD QUALITY CONTROL and additionally as required to ensure conformance of the work to the contractual requirements.

Subcontractor's Nondestructive Examination Personnel Qualifications: The Subcontractor's nondestructive examination (including visual examination) personnel shall be qualified for the applicable nondestructive testing method in accordance with the requirements of ASNT SNT-TC-1A for Levels I, II, or III as applicable. Qualification as an AWS Certified Weld Inspector is an acceptable alternative for visual examination. The Subcontractor shall have on file documentation, affidavits, and records of testing and test results which qualified the nondestructive examination personnel.

DELIVERY, STORAGE, AND HANDLING:

Except as otherwise specified, filler materials and fluxes shall be stored and handled in accordance with the manufacturer's recommendations and approved procedures (off-Site) or the *INEEL Welding Manual,* Volume 2 (on-Site).

SAFETY:
As a minimum, safety precautions during welding shall conform to ANSI Z49.1 as well as any additional requirements specified in the subcontract documents.

PART 2--PRODUCTS

GENERAL:
Welding equipment, electrodes, filler material, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator utilizing qualified welding procedures.

MATERIALS:
Filler Material: All filler material used in fabrication shall comply with the AWS filler material specification and shall have a certificate of conformance.

PART 3--EXECUTION

WELDING OPERATIONS:
Both off-Site and on-Site welding shall be accomplished in accordance with the qualified and approved welding procedures using qualified welders and/or welding operators. The use of such procedures will not relieve the Subcontractor of his responsibility for producing weldments conforming to the specified workmanship requirements. Welding shall not be done when the prevailing working or weather conditions could impair the quality of the completed weld.

Welding Processes:
Off-Site: Subject to approval of the Subcontractor's welding procedures, acceptable welding processes are:

Shielded Metal Arc Welding (SMAW)
Gas Tungsten Arc Welding (GTAW)
Flux Core Arc Welding (FCAW)
Gas Metal Arc Welding – Spray Transfer (GMAW)
Gas Metal Arc Welding – Pulsed (GMAW-P)
Stud Welding

Short Arc Gas Metal Arc Welding (GMAW-S) process is not permitted.

Other welding processes may be used subject to specific approval. The Subcontractor shall submit pertinent data and proposed application of said other welding processes for evaluation by the Contractor prior to performing weld procedure qualification.

On-Site and Offsite Using *INEEL Welding Manual*:

Carbon Steel Tubular Sections, Plate and Structural Shapes: Welding shall be done in accordance with the *INEEL Welding Manual* and the applicable INEEL Welding Procedures C-3.5, C-6.13, or C-6.16.

Preparation of Base Metal: Surfaces within 2 in. of any weld location shall be free of any oil, grease, paint, or other material that would prevent proper welding or produce objectionable fumes while welding. If the joints are prepared by arc cutting, the surface shall be ground to bright metal by mechanical means before welding.

Preheat and Interpass Temperature Requirement: Preheat and interpass temperature shall be in accordance with the welding procedure specification.

Welding Requirements: Completed welds shall provide a surface that is free from cracks, seams, laps, lamination, and porosity in excess of the specified acceptance requirements. Arc strikes outside the area of permanent welds shall be avoided on base metal.

Fillet Welds: Fillet welds shall be made to the size and length as indicated. Where length of welds is not specified, the weld shall be continuous for full length of joint. Where spacing of intermittent or staggered weld is shown, the spacing shall be considered maximum only.

Unless fillet sizes are indicated as maximum size, oversize welds shall not exceed the thickness of the thinner part joined. Fillet weld surface shall have a uniform transition from the joined material into the weld deposit. Undercut shall be limited to the requirement of AWS D1.1, or D1.3 as applicable and unfused overlap of the weld deposit shall be unacceptable.

Groove Welds: Groove welds shall be 100% complete joint penetration welds unless otherwise indicated. Groove welds shall be made to the requirements of the drawings and specification.

Stud Welds: Welds for studs and shear connectors shall be made with automatically timed stud welding equipment in accordance with AWS D1.1, Section 7.

Preparation of Base Metal: Surfaces within 2 in. of any weld location shall be free of any oil, grease, paint, or other material that would prevent proper welding or produce objectionable fumes while welding. If the joints are prepared by arc cutting, the surface shall be ground to bright metal by mechanical means before welding.

Weld Repairs:

Defects shall be completely removed by grinding or other approved means to clean, sound metal. Excavated areas shall be MT or PT inspected by ASNT-TC-1A certified personnel to assure defect removal.

Repairs to correct weld defects shall be made using the same procedure used for the original weld or other previously authorized weld repair procedures.

Repaired areas shall be re-examined using the same inspection procedures by which the defect was originally detected and the inspection which was originally specified for the weld.

No more than two repair attempts will be allowed on any one weld:

Cutting out and rebeveling then rewelding is a considered a weld repair.

No further attempts to repair shall be carried out without the written authorization of the Contractor.

Weld repairs subsequent to the first two repair attempts shall be made after receiving written approval of Subcontractor's repair procedures.

Arc Strikes: Cracks and blemishes caused by arc strikes shall be ground to a smooth contour but no more than 1/32 in. of the base metal shall be removed. Arc strikes extending more than 1/32 in. into the base metal shall be considered as a weld defect and repaired as specified.

Cutting Processes:

Tools and Equipment: Tools and equipment used for cutting shall be designed and sized appropriately for the work.

Cutting Requirements: Cuts shall be made in a skilled, workmanlike manner.

FIELD QUALITY CONTROL:

General:

Components with welds will not be accepted unless the welding has been specified or indicated in the design documents or otherwise approved. Welding shall be as specified in this Section except where additional requirements are indicated or specified in other sections.

Inspections, examinations, and tests for welds and weldments shall be performed by qualified inspection, examination, and testing personnel in accordance with the approved procedures. All welds are subject to inspection by the Contractor's Representative who reserves the right to accept, reject or demand removal of welds which are in violation of this specification or the applicable welding procedure specification. The Subcontractor shall provide access for this activity.

Weld Testing and Inspection:

Visual Weld Inspection: All welds shall receive a visual (VT) examination. VT inspection shall be performed, evaluated and documented by the Contractor's Representative for on-site welds and the Subcontractor Representative for off-site welds. Visual examination procedures shall be in accordance with AWS D1.1, Section 6. The evaluation of indications and the acceptance criteria shall be in accordance with AWS D1.1, Table 6.1.

Contractor Inspection: Surveillance will be performed by the Contractors Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 15025

SECTION 15404--PIPING AND PLUMBING

PART 1--GENERAL

WORK DESCRIPTION:
The Subcontractor shall furnish and assemble all equipment, materials, and supplies and perform all work and operations necessary to install the piping systems and appurtenances and to complete the work as shown on the subcontract drawings and specified herein. Upon completing assembly of the piping systems, the Subcontractor shall test as specified herein to verify that the systems are properly assembled as required.

The Subcontractor shall field verify all piping dimensions prior to fabrication and shall maximize shop fabrication of spool pieces to minimize field work time.

Where instruments, valves, equipment, or controls are specified, the descriptive narrative shall govern over the catalog part number or model number.

WORK INCLUDED: Work includes, but is not limited to:

Furnish and assemble all valves, valve tags, tubing, instruments, gauges, mounting brackets, pipe, flanges, fittings, couplings, hangers, supports, and appurtenances as required to complete the work as shown on the subcontract drawings for all piping and appurtenances for process airflow and instrumentation of the vacuum extraction system, including camlock connections to vacuum hoses, pipe supports, and mounting. Work includes all pipe welding and pipe support welding. Work includes all cleaning, testing, and flushing of the piping systems, as specified herein.

RELATED SECTIONS:

Section 01005 – Summary of Work
Section 15025 – Steel Structural Welding

QUALITY CONTROL:
Codes and Standards: Comply with requirements of the current revision of the following codes and standards, as specified in this specification:

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.3 "Chemical Plant and Petroleum Refinery Piping"

INTERNATIONAL CODE COUNCIL

International Plumbing Code

Qualifications: Piping shall be furnished and assembled by a firm/company qualified, accredited, and regularly engaged in this type of work and shall maintain shop and facilities for fabrication and maintenance of subject equipment.

Items of Any One Classification: Items that are used in quantity—such as valves, specialties, accessories, fittings, etc.—shall in each case be the product of one manufacturer and shall be used only for the services recommended by the manufacturer.

Materials, Products, and Equipment: Materials, products, and equipment shall be first quality and be furnished and installed in strict accordance with the subcontract drawings and these specifications.

Certificates of Compliance: Certificates of compliance shall be submitted for any material used in pressure-containing piping components and shall state that the material conforms to the specification listed under "Piping Materials." Unlisted materials may be used, provided Contractor approval is obtained prior to fabrication. Certificates of compliance for all weld filler materials shall be submitted as vendor data. Materials of unknown specification shall not be used for pressure-containing piping components.

Welding and Weld Examination: Welding and examination of all double wall and other pressure piping and pipe supports shall be performed in accordance with Section 15025.

SUBMITTALS:
Submittals for Review:

Catalog cuts and product data for all valves, instruments, specialty items, etc. are required to be submitted and approved by the Contractor before purchase

Submittals for Information: Certificates of Compliance for all pressure-retaining components must be submitted for information before use. Pressure test procedures prior to construction start.

Submittals for Project Closeout: All pneumatic test reports.

PART 2--PRODUCTS

GENERAL:
All materials, products, and equipment shall be as manufactured by the manufacturer specified in this section or an approved equal. All materials furnished shall be permanently marked or tagged to show ASTM designation and type of material. Materials shall not be steel stamped for identification. The finished materials shall be packaged for shipment; pipe ends shall be capped with plastic caps to protect the material from dirt and contamination during shipment and subsequent storage.

Unless otherwise specified, all pipes shall be sized according to the drawings. All valves, unless otherwise specified, shall be sized for the line into which they will be installed.

Piping Materials:

Line Class	Service	Design Press	Max. Temp.	Pipe Material	Valve Body	Vessel/Tank Material	Notes
NN	Process air	6 psia	120°F	Carbon steel (Threaded for <2 in., BW for ≥2 in.)	Carbon steel (Screwed or flanged)	N/A	

NOTES:
Piping material specifications for 6 psia service rating are unless otherwise noted elsewhere in these specifications.

PIPING MATERIAL SPECIFICATION

Carbon Steel
6 psia Service Rating
Line Class: NN

Pipe Size	Description	Code
Pipe		
<2 in.	Carbon steel, Sch 40, threaded ends.	ASTM A53,
2 in. and larger	Same as above except beveled ends.	Grade B
FITTINGS	150# malleable iron, threaded.	ASTM A197
Flanges	150# flat face carbon steel, slip-on.	ASTM A105, ANSI B16.5
Gaskets	Grafoil[R] flange gasket, 1/8 in. thick.	ANSI B16.21
Bolting	Hex head machine bolt with hex nut.	ASTM A307, Grade B
Branch Fittings		
<2-in. header	Reducing tee, 150# malleable iron, threaded ends.	ASTM A197
2 in. and larger	Same as above, except beveled ends.	ASTM A197
Globe Valves		
<2 in.	800# Class, forged carbon steel body, threaded ends.	ASTM A105
2 in. and larger	150# Class, carbon steel body, flanged ends.	ASTM A216 WCB
Check Valves		
<2 in.	150# Class, carbon steel body, threaded ends.	ASTM A105
2 in. and larger	150# Class, carbon steel body, swing check, flanged ends.	ASTM A216 WCB
Ball Valves		
<2 in.	150# Class, carbon steel body, threaded ends, full port.	ASTM A216 WCB
2 in. and larger	150# Class, carbon steel body, flanged ends, full port.	ASTM A216 WCB

PART 3--EXECUTION

Pipe Assembly Examination: The Contractor's Representative shall perform pipe assembly examination in accordance with ASME B31.3, Paragraphs 341 (Metallic Piping) and A341 (Non-Metallic Piping) as required for piping in "Normal Fluid Service," including the following;

Random examination of the assembly of threaded, bolted, and other joints must be performed to satisfy the examiner's criteria that they conform to the applicable requirements. When pneumatic testing is to be performed, all threaded, bolted, and other mechanical joints shall be examined.

Random examination during erection of piping shall be performed, including checking of alignment, supports, and cold spring.

Examination of erected piping for evidence of defects that would require repair or replacement and for other evident deviations from the intent of the design.

For nonmetallic pipe joints, not less than 5% of all bonded joints shall be examined by in-process examination. The joints to be examined will be selected to ensure that the work of each bonder and bonding operator making the production joints is examined.

GENERAL INSTALLATION OF ALL SYSTEMS:

Shall conform to the applicable requirements of the ASME Code for Chemical Plant and Petroleum Refinery Piping (ANSI B31.3) and the Uniform Plumbing Code.

Accessibility: Items—such as valves, controls, access doors, specialties, and accessories—shall be installed so as to be readily accessible for operation, service, maintenance, and repair.

Pipelines: Pipelines shall be assembled in a neat and orderly manner. Piping shall avoid interference with work of the other trades.

Subcontractor shall assemble unions or flanges in addition to those shown on the drawings to facilitate dismantling as may be required. Avoid tool marks and unnecessary pipe threads. Remove burrs formed when cutting pipe. Remove arc strikes, weld spatter, and slag from welded joints by chipping and wire brushing. Tools used on stainless-steel items shall be marked with blue paint and used on stainless-steel items only. Tools used on other materials shall not be used on stainless-steel items.

Joiners (length of pipe made by welding together or coupling together pieces shorter than 20 ft) will not be permitted unless approved by the Contractor's Representative. Where joiners are permitted, welds shall be made by welders and procedures qualified and certified in accordance with the requirements specified in the welding section.

Piping shall be cleaned of dirt, rust, scale, grease, and other foreign matter. Piping shall be kept clean as work progresses. Seal in accordance with underwriters requirements wherever piping passes through firewalls.

Pipe routings and pipe sizes shall be as indicated. Any proposed deviation from the indicated sizes and configurations shall be submitted to the Contractor's Representative for approval prior to implementation. Fabrication and installation tolerance shall be ±1 in. maximum from the locations indicated.

Lines indicated with slopes shall be fabricated and installed to ensure that no pockets remain in the final installation. Cases where a problem is anticipated in sustaining the required slope shall be brought to the Contractor's Representative for resolution.

Indicating instruments shall be placed for easy reading from operating floors or platforms. If 6 ft or more above floors or platforms, set at a 45-degree angle.

Pipe and Tube Bends: A minimum bend radius of five pipe diameters may be used in place of elbows on stainless-steel pipe, carbon steel pipe, and copper tubing, provided room exists for the bend (not fitting to fitting). All bends shall be free from wrinkles, kinks, and thin or flat spots. "Out of Roundness" shall not exceed 6% between the minimum and maximum cross-sectional dimensions. All bends must be completed prior to beveling, flanging, or cutting to length.

PIPE JOINTS:

Threaded Pipe Joints: The threads of screwed joints of pipe, fittings, and couplings shall conform to the applicable requirements of ANSI B2.1. Threading shall provide the proper number of perfect threads to produce full metal-to-metal contact when assembled. Male threads shall be wrapped with Teflon tape or lubricated with an approved lubricant recommended for the service involved. The first two male threads shall not be wrapped.

Welded Pipe Joints: Welded joints shall be made as specified in Section 15025, "Welding."

Welding on Galvanized Pipe: Where it becomes necessary to do welding on galvanized pipe or components, the galvanizing shall be cleaned away a minimum distance of 3 in. from the welding point. After welding and weld examination are completed, the cleaned areas and ungalvanized components shall be coated with a hand-applied zinc-rich compound to the same thickness as the adjoining pipe.

EQUIPMENT, INSTRUMENTS, ETC.:
Equipment shall be set in place, aligned, connected, and made ready for operation. Connections and required safety devices shall be included. Initial lubrication shall be provided. Controls shall be set for efficient, stable operation.

Instruments and controls shall be placed and supported in a safe, rigid, neat, and orderly manner whether mounting is detailed or not detailed on the drawings. They shall be free from undue stresses and made suitable for normal use. Wall-mounted supports shall be of the type as recommended by the manufacturer of the instrument/control used and shall be provided and installed by the Subcontractor even if not indicated on the drawings.

All of the above shall be protected from damage during and after installation. At completion, work shall be free from tool marks, discolorations, cracks, scratches, chips, and other defects.

HANGERS, SUPPORTS, AND FASTENERS:
Piping shall be adequately supported during installation. Where permanent supports are not available at the time of piping erection, temporary supports shall be provided, as required. Piping shall not be temporarily supported from other piping or conduit.

Pipe hangers shall be fabricated and installed, as shown on the subcontract drawings. Where interferences occur with hanger placement, the Subcontractor shall submit an alternative position to the Contractor's Representative for approval.

Supports shall include wall brackets, riser clamps, hanger rods, pipe stands, pipe clamps, rollers, insulation protection saddles, pipe saddles, steel sections, shims, sleepers, and other suitable devices that may be required for the proper installation of piping.

FLUSHING: All piping systems shall be cleaned by flushing after fabrication and inspection operations are completed and after the final tie-in welds have been made.

Carbon steel lines shall be flushed with clean potable water.

Flushing velocity shall be high enough to entrain dirt and debris.

Duration of flushing shall be continuous until discharge water looks clean. To ensure the absence of moisture after flushing, the lines shall be blown dry with filtered compressed air.

General. The following requirements apply to both air and liquid lines:

Lines shall not be flushed into vessels or other equipment in which debris could settle.

Valves shall be in the open position, and check valves shall have the discs removed during the flushing operation.

Where practicable, in-line instruments shall be removed from the lines and instrument lines shall be disconnected prior to flushing.

Where it is impractical to remove the in-line instrument, permission shall be obtained from the Contractor's Representative to leave the instrument in-line, but the removable internals shall be removed.

Piping specialty items shall be retained in-line during the flushing operation; however, for items such as filters, the internals shall be removed.

Verification of cleanliness shall be by visual examination of an in-line 12-mesh strainer on the line discharge. The strainer shall be replaced after the flushing duration is completed. Additional flushes through the strainer shall be performed until visual examination reveals no debris collection on the strainer.

TESTING:

Piping shall be pressure tested after assembly in accordance with ASME B 31.3, Paragraph 345 using approved testing procedures. Testing procedures including a sketch/print indicating valve lineup and test boundaries shall be submitted for information. Piping material shall be cleaned externally and cleaned and flushed internally prior to testing. The Contractor's Representative will witness the tests. Joints, including welds, shall be exposed during initial piping testing. Upon completion of testing, piping shall be blown dry by using filtered compressed air. Openings shall be covered, capped, or plugged to prevent ingress of foreign matter. Testing shall include the following:

(a) Instrument lines shall be disconnected prior to testing to prevent damage to instruments. Line-mounted instruments shall be removed from the line.

(b) Equipment and other items not designed for the full test pressure shall be isolated from the test or removed from the line.

(c) Piping shall be pneumatically tested at the pressure, as indicated in Table 1.

(d) The test pressure shall be continuously maintained for a minimum of 10 minutes and at the required examination pressure for such additional time as may be necessary to conduct the examination of joints for leakage.

(e) Gauges listed in the testing procedures for performing pressure testing shall be calibrated. Test pressure shall be not less than 10% nor more than 90% of the gauge range. Pressure gauges shall be accurate to within 2% of span.

(f) Instruments and other items removed or disconnected prior to testing shall be reconnected or reinstalled and made ready for operation.

(g) A pressure-relief device shall be provided in the testing apparatus, having a set pressure equal to the test pressure plus the lesser of 50 psi or 10% of the test pressure.

(h) Records shall be made of each piping system during the testing, including:

- Date of test
- Identification of piping system tested
- Test fluid
- Test pressure
- Certification of results by examiner

These records shall be submitted to the Contractor after testing for information.

Table 1. Pressure testing requirements.

Line Class or Piping		Type of Test	Minimum Test Pressure
NN	Process air	Pneumatic	6 psia

FIELD QUALITY CONTROL:
Surveillance will be performed by the Contractor's Inspector/Contractor's Representative to verify compliance of the work to the drawings and specifications and to ensure that the required examinations are being performed.

END OF SECTION 15404

SECTION 15810 – VENTILATION AND TANK COVER

PART 1--GENERAL

SUMMARY:
The Subcontractor shall furnish and install all equipment, materials, and supplies and perform all work and operations necessary to install the ventilation and tank cover components and appurtenances and to complete the work as shown on the subcontract drawings and specified herein. Upon completing installation of the ventilation and tank cover components, the Subcontractor shall test as specified herein to verify that the systems are properly installed and operate as required.

The ventilation system will be directly tied into the air flow from the building in efforts to provide a positive flow direction through the project area. Air will enter the through doors and vents of the enclosure, be drawn into the tank through the working platform access area, then extracted from the tank and processed through the HEPA filter housing.

The tank will have a synthetic fabric cover fixed at each end of the tank with a traveling cart in between. The cart with have polyurethane flange wheels that roll along the cut edge of the lower half of the tank and will have reels on each end with a five foot wide opening between the reels so that a reel on one end will wind up one end of the cover and the reel on the other end will unwind the other end of the cover with the five foot space traveling along the tank. The side edges of the cover will be held down by bungee cords anchored to timbers placed along the sides of the tank. The bungee cords will be removed and reinstalled as necessary for the cart to move.

The Subcontractor shall field verify all air flow connections, prior to fabrication and shall maximize shop fabrication of ductwork to minimize field work time.

The Subcontractor shall fabricate the cart used for the tank cover and shop test for proper operation prior to installation at the site.

Section Includes: Work includes, but is not limited to:

Air flow components associated with pulling air from the temporary enclosure, through the tank and exhausting through a HEPA filter.

Air flow components associated with pulling air from the vacuum system enclosure and exhausting through a HEPA filter.

Weather Enclosure vents
Vacuum system enclosure vents
Air hoses connections and supports

Tank cover components associated with providing a temporary cover with a traveling opening to prevent the debris in the tank from being scattered around the work site but allow access to the tank to remove the sludge

RELATED SECTIONS:

01005	Summary of Work
13800	Weather Enclosure

15883 HEPA Filter Housing

EQUIPMENT WARRANTY:
Vendor shall supply as part of proposal package a copy of Equipment warranty documenting formal warranty coverage for at least one (1) year from date of shipment.

REFERENCES:
SMACNA
ASTM D1785
NFPA 90A

SUBMITTALS:
Submittals for Approval:
- Catalog cuts of ventilation components including the wall vents and air flow hose shall be submitted for review and approval prior to purchase.
- Catalog cuts of the tank cover components including the cover material, the reels, the cart wheels and cart frame members shall be submitted for review and approval prior to purchase.
- Shop drawings showing principal dimensions, details of construction, and materials shall be submitted for review prior to purchase.

Submittals for Information:
Catalog cuts of all purchased items such as stationary louver, elbows, transitions, flow, and support items for the ventilation system and cover material, wheels and reels for the tank cover system shall be submitted for information before final acceptance.

Submittals for Project Closeout: None.

QUALITY CONTROL:
The Subcontractor shall comply with the requirements of the current revision of the following codes and standards, as referenced and specified in this section.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1785 "Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120"

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems"

PART 2--PRODUCTS

GENERAL:
All materials, products, and equipment shall be manufactured as specified on the contract drawings and in this section.

System components shall be designed to operate at the given design parameters at an altitude of 5,000 ft.

MATERIALS:

Fans:

- ACME model 2115 (or approved equal)
- Axial in-line fan
- Partial width wheel rated for 3.0" w.g. at 1350 CFM

HEPA filters:

- Flanders G series (or approved equal)
- 24"x 24" housing
- Flanders GGF filter (or approved equal)
- 24"x24"x11.5" filter
- rated for 1.3" w.g. at 1500 CFM

Material gage, duct reinforcing, and connections shall be in accordance with the SMACNA standard for the given pressure classification.

The Contractor's Representative shall approve duct system material substitutions. In the case of a substitution, the Subcontractor shall provide calculations proving that noise level, total pressure loss, system flow characteristics, and integrity are all equal to or better than the system as designed and specified.

Round Duct Materials: Round duct gauge shall be in accordance with Table 3-2B of HVAC Duct Construction Standards Metal and Flexible, SMACNA. Duct materials shall be G-60 coated galvanized steel of ASTM A653 ("Standard Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-Coated [Galvannealed] by the Hot Dip Process") and A924 ("Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process") grades. Uncoated, polyvinyl-coated, aluminum-alloy coated, or aluminum-zinc alloy coated steel or stainless steel may be used if a minimum corresponding base metal thickness and material strength is provided as approved by the Contractor's Representative. Lock-forming quality is required. The use of an alternative material requires approval by the Contractor's Representative.

Duct Supports: Ducts shall be supported in accordance with standard details of SMACNA "HVAC Duct Construction Standards Metal and Flexible". Structural steel shapes shall be in accordance with *Manual of Steel Construction*, AISC, ASTM A36, "Standard Specification for Carbon Structural Steel."

Cover Material: Commercially available synthetic material shall be used for the cover.

Wheels and Reels: Commercially available wheels and reels shall be used for the cart.

Cart Structural Members: Cart structural members shall be galvanized steel in accordance with ASTM-446-91, Grade A and/or UBC 27-9

PART 3--EXECUTION

FABRICATION AND INSTALLATION OF AIR FLOW HOSE AND DUCTWORK:
Assemble and install ductwork in accordance with recognized industry practices, which will achieve air tight and noiseless systems capable of performing each indicated service. Install each run with a minimum of joints. Align ductwork accurately at connections. Coordinate duct installation with installation of accessories and other associated work of the ductwork system. Installation shall be in accordance with

SMACNA Duct Construction Standards (HVAC, Round, or Rectangular) and the Uniform Mechanical Code.

Ductwork connections shall be in accordance with the applicable SMACNA Duct Construction Standard. Flanged connections shall be installed where shown on the contract drawings. Gasket material for flanged connections shall be 1/8-in. neoprene.

Duct Gauge, Supporting, and Reinforcing: Unless otherwise shown on the subcontract drawings, duct gauge, hangar spacing, and reinforcing shall be in accordance with SMACNA "HVAC Duct Construction Standards Metal and Flexible." Hangars shall be installed in accordance with the requirements of the appropriate SMACNA standard for the duct material gauge, reinforcing, pressure classification, and duct classification unless otherwise shown on the contract drawings.

Equipment Installation: Equipment installation shall be in accordance with SMACNA "HVAC Duct Construction Standards" and the manufacturer's recommendations. Holes for damper rods, thermostats, etc. shall be drilled or machine punched.

Cart Fabrication: The cart shall be fabricated in accordance with the approved drawings using recognized industry practices.

CLEANING AND PROTECTION:
Clean Ductwork Internally: Clean ductwork internally, unit-by-unit as it is installed. Clean the external surfaces of foreign substances that might cause corrosive deterioration of the metal. Or, where air distribution accessories and ductwork are to be painted, clean the surfaces of foreign substances that might interfere with painting or cause paint deterioration.

Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure of polyethylene film or other covering, which will prevent the entrance of dust and debris until the time connections are to be completed.

FIELD QUALITY CONTROL:
Contractor Inspection: The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

ATTACHMENTS:
None.

END OF SECTION 15810

SECTION 15883--HEPA FILTER HOUSINGS

PART 1--GENERAL

WORK DESCRIPTION:

This specification covers the design, fabrication, inspection, testing, cleaning, and shipment of a HEPA filter housing. The housing shall be a bag-out, side access unit, consisting of two sets of filters, each containing two 24 x 24 x 11½ in. fluid seal HEPA filters.

WORK INCLUDED: Work includes, but is not limited to:

Test, furnish and assemble HEPA filter housings meeting the requirements in these specifications and to the configurations shown on the subcontract drawings

Install HEPA filters supplied by BBWI GFE. Support BBWI DOP testing at subcontractor's site.

Furnish and assemble differential pressure gage, switch and instrument tubing.

Coordinate the installation of HEPA filter units with the Vacuum System Section 13121.

QUALITY CONTROL:

Design: HEPA filter housing design shall conform to ANSI N509 and ERDA 76-21, Nuclear Air Cleaning Handbook.

Inspection: All equipment furnished in accordance with this specification will be subject to inspection by the Contractor's Representative during any phase of fabrication or testing.

SUBMITTALS:

See Vendor Data Schedule.

DELIVERY, STORAGE, AND HANDLING:

All components shall be packaged to prevent damage and the entry of dirt or moisture during shipping and outdoor storage for a six month period.

PART 2--PRODUCTS

HEPA FILTER HOUSINGS:

Filter housings shall be fabricated of 14 gage, type 304, 304L, 316 or 316L stainless steel, for an internal pressure of 10 in. w.g.. The design shall meet ANSI N509 and ERDA 76-21.

The housing shall be a side-servicing bank type arrangement that does not require the air to change direction through the housing or as it enters or exits the housing. All joints and seams shall be welded airtight and ground smooth. The unit shall be free of all burrs and sharp edges. All mechanical components and filter slide plates shall be 300 series stainless steel.

Filter housings with multiple filters shall have removal rods to draw the filters to the bag-out position. Filter housings shall have locking arms in each tier to operate the mechanism which engages and disengages the filters on the internal mounting frame. This mechanism shall be such that it will transmit a positive force on both the top and bottom edge of each filter to prevent tipping or binding of the filters as

they are pulled into or away from the knife edge seal. Both the removal rod and the locking arm shall be operated through polyvinyl bag.

The filter housings shall have a removable access door and bag-out port for each tier of filters. There shall be four tie down latches per access door and they shall be spring loaded in such a manner that they pivot away from the bag-out port after release, so that they do not impede the bag-out process. The filter locking arm and access door shall interface in such a manner that the door cannot be closed until the filters are correctly seated in the housing and sealed to the mounting frame.

Doors shall be fitted with closed cell neoprene gaskets in accordance with ASTM-D1056, Grade SCE-43. The gasket shall be mounted to the door (as opposed to the housing) and shall be manually replaceable (after door has been removed).

On the upstream side of each filter position there shall be a smooth inlet design that provides a minimum 3/4 in. depth recess around the upstream perimeter of the filter to limit the buildup of contaminants in crevasses or fillets that would have been caused by the junction of the filter's integral frame and the housing wall. All flanges of the housing that connect to the system shall turn to the outside.

The filter-to-frame seal in each filter housing shall be effected by means of a continuous knife edge on the mounting frame that mates to a continuous perimeter channel on the face of the filter which has been filled with a viscous, non-drying fluid. The knife edge seal frame shall be square to within +1/16 in.

The filter housing shall be designed to fit fluid seal HEPA filters (24 x 24 x 11½ in.) supplied by BBWI GFE.

Each filter housing access door shall have a bag-out port inside the door that has been hemmed on its outer edge to prevent tearing of the bag. There shall be two continuous ribs on the outside of the port to hold the bag's elastic shock cord and the safety strap during the bag-out operation.

One PVC bag shall be furnished for each access door on each filter housing. It shall be 0.008 in. thick, amber in color with a transparent, smooth textured finish, and shall have an elastic shock cord hemmed into the mouth of the bag for a firm fit when stretched around the bag-out port. A stock number shall be provided with the bag.

A nylon safety strap shall be provided with each bag-out port to prevent the bag from slipping off during the bag-out procedure. The strap shall have a neoprene laminate on one side to prevent slippage. A cinching strap shall also be provided with each bag-out port to tie off the slack in the bag while the ventilation system is operating.

Each door shall be equipped with an exterior metal pocket for the filter housing instruction manual which shall be provided at the same time the housing is delivered and shall contain complete, detailed and separate instructions on filter arrangement including installation, operation, maintenance, and spare parts. The manual shall be contained in weatherproof bags.

For DOP test sections, all filter testing shall be able to be conducted from a location outside of the system using apparatus and devices which are supplied as an integral part of the test sections including mixing devices and sample ports. The upstream and downstream test chambers shall contain identical mixing devices to mix and disperse a uniform challenge air/aerosol ahead of each filter, and sample the effluent upstream and downstream of the filter being tested. Challenge aerosol inlet ports and upstream and

downstream sample ports shall be provided for each HEPA filter. The pressure drop across each test section shall be no greater than 0.25 in. w.g. (at 1000 cfm per filter) during the test. All mixing devices shall be designed to swing aside when testing has been completed.

The in place testing design shall be proof tested in a multiple filter. It shall be shown that the leaking filters can escape detection in the conventional ten duct diameter test wherein the entire bank is challenged, but that they can be "found" by the individual efficiency test. The proof test shall include four test arrangements using various plenum and transition pieces for a comparison of efficiency readings under different conditions. All efficiency readings shall be accompanied by upstream sample readings taken at a minimum of fifteen points ahead of each filter on three planes. The combined assembly including filter housing and test sections shall be the product of a single manufacturer.

DOP test section challenge aerosol inlets shall be 1 in. IPS, Schedule 40, Type 304 stainless steel. Sample ports shall be ½ in. IPS, Schedule 40 Type 304 stainless steel. These connections shall be provided with Type 304 stainless steel pipe caps.

The filter housing shall be provided with flanges for connecting to the ductwork transitions pieces. Furnish the required gaskets.

Static pressure ports shall be located on top of the housing upstream and downstream of the filters. Connections shall be 1/4 in. pipe nipple with cap.

Instrument Tubing: Tubing shall be stainless steel Type TP304 per ASTM A269. Fittings shall be compression type and shall be Swagelok or approved equal.

Differential Pressure Gauge: The gauge shall be diaphragm actuated, shall have 3-7/8 in. diameter white dial with black figures and graduations, shall have pointer zero adjustment and shall be furnished complete with two static pressure tips, fittings for 1/4 in. metal tubing and means for mounting the gauge. Gauge shall be Magnahelic No. 2003-AF reading to 0-3 in. water, in 0.10 in. divisions as manufactured by Dwyer Instruments, Inc., or approved equal.

Differential Pressure Switch: Differential pressure switches shall be diaphragm operated to actuate two single pole double throw snap switch. Motion of the diaphragm shall be restrained by a calibrated spring that can be adjusted to set the exact pressure differential at which the electrical switch will be actuated. Motion of the diaphragm shall be transmitted to the switch button by means of a direct mechanical linkage operating range of the switches shall be 0.5 to 6.0 in. of water. Switches shall be Dwyer Instruments, Inc., Catalog No. 1627-5 or approved equal.

PART 3--EXECUTION

INSTALLATION:

Installation of Equipment: All equipment shall be installed in conformance with the manufacturer's recommendations, this specification and the drawings. Equipment supports shall be independent of associated piping and ductwork, component brackets and supports or other similar attachments.

Filters: The high efficiency HEPA filters (Flanders Model No. T-007-0-02-05 NU Size GG-F) shall be supplied by BBWI GFE and assembled by the Subcontractor in accordance with the subcontract drawings and these specifications.

QUALITY CONTROL TESTING:
Subcontractor Supplied Testing:

General: A housing leak test and an in-place DOP test are required.

Test programs and procedures shall be submitted for the housing leak test and filter fit test specifying test to be performed, the acceptance criteria, and time schedule of testing. Tests shall be made only by persons who have demonstrated their competence to satisfactorily make the specific test and certified in accordance with ANSI N510-1980, N509, and ERDA 76-21.

Housing Leak Test: The test is used to verify the leak integrity of the filter housing assembly. The presence of leaks is disclosed by a pressure decay test to be conducted prior to shipment from the factory. In this test the housing shall be blanked off at the inlet and the outlet and shall be tested by the pressure decay method in accordance with ANSI N510-1980 to 10 in. w.g. as specified in Table 4-4. Following this test, each filter position shall be fitted with an airtight filter-shaped plug and the housing knife edge shall be tested by the pressure decay message in accordance with ANSI N509-1980 to 10 in. w.g. as specified in ANSI N509-1980, Table 4-4.

If the presence of leaks is shown, the leaks are then located by the bubble method and repaired after which the housing is retested by the pressure decay method. A leak indication is any bubble 1/16 in. (0.06 in.) diameter that forms in 1 second, or a bubble 9/32 in. (0.28 in.) that forms in 1 min. Tests shall be performed in accordance with ANSI/ASME N510, Paragraph 6.

Test reports shall be submitted for approval following testing. Failed tests and necessary repairs shall also be reported and identified as to location.

Filter Fit Test: After fabrication, each of the filter housings shall be tested for filter fit. HEPA filters, of type Flanders Model No. T-007-0-02-05 NU Size GG-F (dimensions of 24 x 24 x 11-1/2 in.), shall be placed in each of the filter housings. After the filter elements are in place, visual inspection shall confirm that the elements fit without binding and that the seal is completed.

In-Place DOP Test: The in-place DOP test shall be performed at INEEL by others after the filters are installed. Penetration shall be limited to the 0.03 percent and, if exceeded, the filters must be resealed and retested until an efficiency of 99.97 has been achieved. The Subcontractor shall furnish all labor and materials required should resealing of the filters be required.

FIELD QUALITY CONTROL:
Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

END OF SECTION 15883

SECTION 16000--ELECTRICAL GENERAL PROVISIONS

PART 1--GENERAL

WORK DESCRIPTION:

Work Included: The general work associated with electrical systems and equipment and to be performed as part of the electrical contract includes identification, tests, inspections by governing authorities, startup of electrical systems and equipment, operating and maintenance manuals, as built drawings, final cleaning of electrical work, and similar work.

Wiring and Power Distribution: Incoming service as shown, transformers, panel boards, enclosures, boxes, conduit systems, raceways, cable, wire, wiring devices, overload protection, equipment connections, grounding system, and similar work, all as indicated on the electrical drawings and elsewhere in the contract documents. Power and instrumentation wiring shall be run in separate conduits, conduit runs and panels.

Lighting: General light fixtures for both interior (fluorescent) and exterior (low-pressure sodium vapor) lighting, including emergency lighting and exit signs.

Codes and Standards:

Underwriters Laboratories (UL): All materials, appliances, equipment, or devices shall conform to the applicable standards of Underwriters Laboratories, Inc. All material, appliances, equipment, or devices shall be listed and/or labeled UL.

National Electrical Code (NEC): All installations and electrical work shall comply with the applicable provisions of the latest edition of the National Electrical Code, NFPA 70.

Standard for Electrical Safety Requirements for Employee Workplaces (NESC): All installations and electrical work shall comply with the applicable provisions of the latest edition of the NESC, NFPA 70E.

Project Record Documents

Submit under the provisions of the Vendor Data Schedule. All actual installations under this division shall be documented unless otherwise noted in the individual specification. All results of inspections and tests shall be documented and submitted as described in the individual specifications.

Completed electrical system shall conform to applicable provisions of the Special Conditions, the Technical Specifications, and the subcontract drawings.

SUBMITTALS:

Before Final Acceptance:

Operational test results of all equipment, controls, and devices installed by the Subcontractor.

PART 2--PRODUCTS

GENERAL:
Furnish all labor, materials, equipment, and appliances required for the complete the installation of the electrical system. All labor, materials, service, equipment, and workmanship shall conform to the applicable chapters of the NEC, the National Electrical Safety Code (NESC), Occupational Safety and Health Administration (OSHA), and the terms and conditions of the electrical utility. The Subcontractor shall complete all modifications required by these codes, rules, regulations, and authorities without additional charge to the Contractor. All personnel engaged in the work must be qualified and appropriately trained per INEEL requirements.

CONDITION OF PRODUCTS:
Except as otherwise indicated, furnish new electrical products, free of defects and harmful deterioration at the time of installation. Provide each product complete with trim, accessories, finish, guards, safety devices, and similar components specified or recognized as integral parts of the product or required by governing regulations.

Unless otherwise indicated by the drawings or specifications or approved in writing, the materials and/or equipment furnished under these specifications shall be the standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's standard design.

UNIFORMITY:
Where multiple units of a product are required for the electrical work, provide identical products by the same manufacturer without variations except for sizes and similar variations as indicated.

PART 3--EXECUTION

COORDINATION OF ELECTRICAL WORK:
General: It is recognized that the subcontract documents are diagrammatic in showing certain physical relationships that must be established within the electrical work and in its interface with other work, including utilities and mechanical work, and that such establishment is the exclusive responsibility of the Subcontractor.

Arrange electrical work in a neat, organized manner with conduit and similar services running parallel with the primary lines of the building construction and with a minimum 7 ft, 0 in. of overhead clearance.

Locate operating and control equipment properly to provide easy access and working clearance in accordance with the NEC.

Advise other trades of openings or clearances required in their work for the subsequent move-in and assembly of large units of electrical equipment.

Electrical connections shall be tightened to torque specifications stated by the equipment manufacturer.

QUALITY CONTROL TESTING:
Subcontractor-Supplied Testing: Upon completing installation of all systems and equipment, but prior to project close out, the Subcontractor shall conduct an operational test of all equipment, controls, and devices installed or modified by the Subcontractor. All equipment shall test satisfactory or be repaired at no additional cost to the Contractor.

The Subcontractor shall test all devices in the presence of the Contractor's Representative. Subcontractor shall coordinate testing with the Contractor and schedule testing a minimum of 2 weeks in advance of the test. The Subcontractor shall inform the Contractor in writing of the scheduled test to allow the Contractor to designate the Contractor's Representative. This operational testing is in addition to testing required in separate sections of this specification.

FIELD QUALITY CONTROL:
The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

END OF SECTION 16000

SECTION 16120--CABLE, WIRE, CONNECTORS, AND MISCELLANEOUS DEVICES

PART 1--GENERAL

WORK DESCRIPTION:
Provide and install cables, wire, and wiring connectors of sizes, ratings, materials, and types as shown on the drawings.

Work Included:
Work includes, but is not limited to, installing all cables, wire, and wiring connectors as shown on the drawings.

Related Sections:
Section 16000 – Electrical General Provisions

Codes and Standards:
All equipment provided and the installation of cables, wires, connectors, and miscellaneous devices shall comply with the applicable sections of the following codes and standards:

NFPA 70 – "National Electrical Code"

SUBMITTALS:
Prior to Purchase:
Submit product data for all wiring, cables, and connectors.

Before Final Acceptance:
Submit cable insulating resistance test results for all cables over 400 V.
Submit electrical continuity test results of all conductors over 400 V.

PART 2--PRODUCTS

MATERIALS:
600-V Wiring:
Conductors for power and lighting branch circuits shall not be smaller than No. 12 AWG.

Conductors shall be stranded for all sizes of wire and cable larger than No. 10 AWG.

Conductors shall be copper for all sizes.

Wire insulation shall be type THHN/THWN for all 600-V conductors unless otherwise specified.

Wiring shall be color coded as indicated below:

Conductors:

System	Phase A	Phase B	Phase C	Neutral	Ground
208/120	Black	Red	Blue	White	Green
480/277	Yellow	Orange	Brown	Gray	Green

For large conductors not generally furnished with colored insulation, phase identification shall be achieved by the use of plastic tape or sleeves of the appropriate color. Yellow phase tape shall consist of two separate bands at each application point in order to avoid confusion with white, gray, or orange after aging. All wire markers and phase tape shall be covered by clear heat shrink sleeving to protect the markings.

CONNECTORS:
Spring-type pressure connectors, such as Scotchlock, shall be used for splicing No. 8 AWG and smaller.

Splitbolt and/or lug-type connectors such as Burndy shall be used for splicing No. 6 AWG and larger.

Crimp on spade or ring tongue lug connectors for connection to terminal boards such as Stakon@ shall be used.

Wire/Device Identification: All conductors shall be identified with self-adhering, oil- and moisture-resistant vinyl labels, covered with clear heat shrink tubing or white heat shrink tubing with black typed-on letters with nonsmearing ink as manufactured by Brady, T&B, or approved equal. Hand-lettered labels shall not be used. All conductors shall be labeled with point-to-point destination, as shown on the drawings. Identification and labeling shall comply with the appropriate provisions of Section 16000.

PART 3--EXECUTION

INSTALLATION:
General: Install electrical cable, wire, and connectors as indicated on the drawings, in accordance with manufacturer's written instructions, applicable requirements of NEC and National Electric Contractors Association's "Standard of Installation," and in accordance with recognized industry practices to ensure products serve intended function.

Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.

Pull conductors together where more than one is being installed in a raceway. Do not exceed the conductor manufacturer's recommended pulling tension.

Use pulling compound or lubricant, where necessary; pulling compound shall not deteriorate conductor insulation.
Keep conductor splices to a minimum. Splices shall not be located in conduit or associated conduit fitting.

Install splices and taps that have mechanical strength and insulation rating equivalent-or-better than conductor.

Use splice and tap connectors that are compatible with conductor material.

QUALITY CONTROL TESTING:

Subcontractor-Supplied Testing:
Meggering: Prior to terminating, test all cable or wire (for connections greater than 400 V) for insulation resistance with megger (1,000-V megger for 600-V insulation). Any wire or conductor with less than 10 megohms to ground shall be replaced before proceeding with termination. List the conductors tested on required test data submittal sheet.

Electrical Continuity: After conductor connectors (for connections greater than 400 V) are installed and conductors are labeled, but prior to termination to terminals or devices, an electrical continuity test shall be performed on each conductor using a battery-powered buzzer or ohmmeter to determine that all power, control, grounding, and other conductors are properly installed and identified. List all conductors tested on required test data submittal sheets. Subcontractor personnel must be on hand to support testing as needed. The Contractor's Representative shall provide the Test Data Submittal Sheets.

FIELD QUALITY CONTROL:
The Contractor's Representative will conduct surveillance to ensure compliance with the drawings and these specifications.

END OF SECTION 16120

SECTION 16160--PANELBOARDS

PART 1--GENERAL

WORK DESCRIPTION:

Provide and install distribution and power panelboards of sizes, ratings, materials, and types as shown on the panel schedules. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of trip ratings as shown on the panel schedules.

Work Included:

Work includes, but is not limited to, furnishing and installing the panelboards shown on drawings and specifications including the enclosures, bus bars, breakers, covers, circuit directories, and wire labeling (as required). Terminate all conductors inside enclosures. All panelboards, especially those where knockouts have been pulled or holes sawed in the enclosure, shall be thoroughly cleaned and vacuumed to ensure that all metal scraps and shreds are removed before the cover is installed.

Related Sections:

Section 16000 – Electrical General Provisions
Section 16450 – Grounding

Codes and Standards:

All equipment provided and the installation of panelboards shall comply with the applicable sections of the following codes and standards:

NECA	(National Electrical Contractors Association) "Standard of Installation"
NEMA 250	"Enclosures for Electrical Equipment (1,000 Volts Maximum)"
NEMA AB 1	"Molded Case Circuit Breakers"
NEMA ICS 2	"Industrial Control Devices, Controllers and Assemblies"
NEMA ICS 4	"Terminal Blocks for Industrial Control Equipment and Systems"
NEMA KS 1	"Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)"
NEMA PB 1	"Panelboards"
NEMA PB 1.1	"Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less"
NFPA 70	"National Electrical Code"

SUBMITTALS:

Prior to Purchase:

Submit shop drawings, indicating outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker, and fusible switch arrangement and sizes.

Before Final Acceptance:

- Submit as-built drawings showing actual locations of panelboards and circuit arrangements.
- Submit steady-state load current test results.
- Submit breaker inspection and test results.

PART 2--PRODUCTS

MATERIALS:

Bussing Assembly and Temperature Rise: All bussing shall be copper. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed a 50°C rise above ambient. Heat rise tests shall be conducted in accordance with UL Standard 67. The use of conductor dimensions will not be accepted in lieu of actual tests. All panelboards shall have a ground bus and a neutral bus installed.

Fusible Switch Assemblies: Fusible switch assemblies shall meet the requirements of Standard NEMA KS 1. They shall be quick-make, quick-break, load interrupter enclosed knife switches with an externally operable handle. Interlocks shall be provided to prevent opening the front cover with the switch in the ON position. The handle shall be lockable in the OFF position. The fuse clips shall be designed to accommodate Class R fuses.

Molded Case Circuit Breakers: Circuit breakers shall meet the requirements of Standard NEMA AB 1 with integral thermal and instantaneous magnetic trip in each pole. Circuit breakers shall be equipped with individually insulated, braced, and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, and individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF. Provisions for locking each breaker in the open position shall be provided. Provisions for additional breakers shall be such that no additional connectors will be required to add the breakers.

Integrated Equipment Short Circuit Rating: Each panelboard, as a complete unit, shall have a factory-established short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the drawings. Short circuit current rating shall be established by the factory testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices in the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be in accordance with UL Standard 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Factory testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be factory marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

Cabinet: Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel shall be specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. An interior metal panel for mounting terminal blocks and electrical components shall be provided. Cabinets shall be equipped with latch and tumbler-type lock on door of trim. Doors over 48 in. long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. Two keys shall be furnished. As required, metal barriers to form separate compartments for wiring of different systems and voltages shall be provided. End walls shall be removable. Finish shall be gray backed enamel electro-deposited over clean, phosphatized steel. A circuit directory frame and card with clear plastic covering shall be provided on the inside of the door. The directory shall be typed by the Subcontractor and shall indicate the area and function served by each breaker.

Safety Barriers: The panelboard interior assembly shall be dead front with the panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to the fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

UL Listing: Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When required, panelboards shall be suitable for and marked for use as service equipment in orange letters.

Hinged Cover Enclosures: Hinged cover enclosures for interior use shall be constructed in accordance with NEMA 250, Type 1 steel enclosures. The covers shall be a continuous hinge, held closed by key and supplied with two keys. An interior metal panel for mounting terminal blocks and electrical components shall be provided.

Terminal Blocks: Terminal blocks shall be NEMA ICS 4. Power terminals shall be unit construction type with closed back and tubular pressure screw connectors, rated at 600 V. Signal and control terminals shall be modular construction type suitable for channel mounting with tubular pressure screw connectors rated at 300 V. A ground bus terminal block, with each connector bonded to the enclosure, shall be provided.

PART 3--EXECUTION

INSTALLATION:

Install panelboards as indicated on the drawings and in accordance with manufacturer's written instructions, applicable requirements of NEC and National Electrical Contractors Association's "Standard of Installation," and complying with recognized industry practices to ensure that the products serve their intended function.

Provide filler plates for unused spaces in panelboards. Provide typed circuit director for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Provide engraved nameplates under the provision of Section 16000.

Ground and bond the panelboard enclosures according to Section 16450.

QUALITY CONTROL TESTING:

Subcontractor-Supplied Testing: Perform visual inspection to determine that equipment installed conforms to NEC, these specifications, and the drawings. Measure steady-state load currents at each panel board feeder; rearrange circuits in the panelboard to balance the phase loads to within 20% of each other. Maintain proper phasing for multiwire branch circuits.

FIELD QUALITY CONTROL:

The Contractor's Representative will conduct surveillances to ensure compliance of the work with the drawings and specifications.

END OF SECTION 16160

SECTION 16450--GROUNDING

PART 1--GENERAL

WORK DESCRIPTION:

Provide and install grounding of types, ratings, materials, and sizes as shown on the drawings.

Work Included:

Work includes, but is not limited to, furnishing and installing the grounding as shown on drawings and specifications including the grid wire, grounding rods, ground bars, other components, and accessories needed for a complete system.

Related Sections:

Section 16000 – General Electrical Provisions

Codes and Standards: All equipment provided and the installation of the grounding system shall comply with the applicable sections of the following codes and standards:

ANSI C2	"National Electric Safety Code"
NETA ATS	(International Electrical Testing Association) "Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems"
NFPA 70	"National Electrical Code"

SUBMITTALS:

Submit manufacturer's data for grounding electrodes and connections prior to purchase.

Submit reports of inspections and tests, and of overall resistance to ground and resistance to each electrode, before final acceptance.

Submit as-built drawings showing actual location of components and grounding electrodes before final acceptance.

PART 2--PRODUCTS

MATERIALS:

Equipment grounding conductors shall be green insulated or bare copper, sized and located as shown on the drawings.

Ground rods shall be a minimum of 5/8-in.-diameter and 10-ft-long copper clad steel.

Ground connections below grade shall be made by the exothermic welding process or UL listed nonreversible compression fittings. Exothermic welds shall be Cad weld or approved equal. Nonreversible compression fittings shall be Burndy HyGround or approved equal.

PART 3--EXECUTION

INSTALLATION:
Install a complete grounding system as indicated on the drawings and in accordance with applicable requirements of NEC, NESC, and complying with recognized industry practices to ensure that products serve their intended functions and comply with requirements.

All exposed non-current-carrying metallic parts of electrical equipment, raceway systems (including manholes), cable trays, air ducts, building steel, and neutral conductors of the wiring system shall be grounded.

Conduit shall not be used as the ground conductor.

Grounding Rods: Grounding rods shall be driven so that the top of the rod is 1 ft below finished grade.

Exothermic Welds: Exothermic welds shall be made in accordance with the manufacturer's written recommendations.

QUALITY CONTROL TESTING:

Subcontractor-Supplied Testing: Perform visual inspection to determine that the grounding installation conforms to NEC, these specifications, and the drawings. Test and inspect the grounding system in accordance with NETA ATS, except Section 4. Perform and document inspections and tests listed in NETA ATS, Section 7.13. Subcontractor personnel must be on hand to support testing, as needed.

FIELD QUALITY CONTROL:
The Contractor's Representative will conduct surveillances to ensure compliance with the drawings and specifications.

END OF SECTION 16450

SECTION 16460--TRANSFORMERS, GENERAL LIGHTING, AND DISTRIBUTION DRY TYPE, INDOOR AND OUTDOOR, UNDER 600V

PART 1--GENERAL

WORK DESCRIPTION:

Provide and install transformers of sizes, ratings, and types as shown on the drawings. Transformer construction will be in accordance with this specification.

Work Included:

Work includes, but is not limited to, furnishing and installing the various sizes and descriptions of transformers shown on drawings and installed in the locations indicated in compliance with these specifications, all provisions of the NEC, NESC, and AE Standards as to clearances, grounding, location, local disconnects, NEMA ratings, and load balancing whether or not those things are shown in exact detail on the drawings.

Related Sections:

Section 16450 – Grounding

Codes and Standards:

All equipment provided and the installation of dry-type transformers shall comply with the applicable sections of the following codes and standards:

NEMA ST 1	"Specialty Transformers (Except General-Purpose Type)"
NEMA ST 20	"Dry-Type Transformers for General Applications"
NETA ATS	(International Electrical Testing Association) "Acceptance Testing Specification for Electrical Power Distribution Equipment"
NFPA 70	"National Electrical Code"

SUBMITTALS:

Submit product data that provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise prior to purchase.

Before Final Acceptance:

Submit test reports indicating loss data, efficiency, and sound level readings at 25, 50, 75, and 100 percent rated load. Submit other test reports as identified.

Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Underwriters Laboratory, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

Submit as-built drawings indicating actual location of transformers and transformer hookup.

PART 2--PRODUCTS

MATERIALS:

Single-phase transformers shall be 480 V primary and 120/240 V, 3-wire secondary. Three-phase transformers shall be 480-V delta primary and 208Y/120-V Wye, 4-wire secondary.

Transformers less than 15 kVA shall have two 2.5% below-rated voltage and two 2.5% above-rated voltage full capacity taps on the primary windings. Transformers 15 kVA and larger shall have winding taps in accordance with NEMA ST 20. Transformers 25 kVA and larger shall have a minimum of four 22% full-capacity primary taps—two above- and two below-rated voltage. Rated voltages shall be designated on the drawings.

Transformers 15 kVA and below shall be Class 185 with 115°C temperature rise, and transformers 16 kVA and above shall be Class 220 with 150°C temperature rise above ambient, 30°C. All insulating systems shall be in accordance with NEMA Standard ST 20 factory-assembled air-cooled dry type transformers.

Transformer coils shall be of the continuous wound construction and shall be impregnated with nonhydroscopic, thermosetting varnish with terminations brazed or welded.

All cores shall be constructed of high-grade, nonaging silicon steel with high-magnetic permeability and low hystersis and eddy current losses. Magnetic flux densities must be kept well below the saturation point. The core laminations shall be clamped together with structural steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated therefrom by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. On transformers 500 kVA and smaller, the vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure.

Transformers 15 kVA and larger shall be in a ventilated sheet steel enclosure of a heavy gauge, as described in the NEMA standards. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and NEC standards for ventilated enclosures. Single-phase transformers through 75 kVA and three-phase transformers through 45 kVA shall be designed so they can be either floor or wall mounted. Single-phase transformers larger than 75 kVA and three-phase transformers larger than 45 kVA shall be floor-mounted design.

The entire transformer enclosure shall be de-greased, cleaned, phosphatized, primed, and finished with gray, baked enamel.

The maximum temperature of the top of the enclosure shall not exceed 50°C rise above ambient of 30°C. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.

Sound levels shall be guaranteed by the manufacturer not to exceed the following:

1 to 5 kVA:	40 dB
15 to 50 kVA:	45 dB
51 to 150 kVA:	50 dB
151 to 300 kVA:	55 dB
301 to 500 kVA:	60 dB

Basic impulse level shall be 10 kV for transformers less than 300 kVA.

The transformer shall be listed by Underwriters' Laboratory for the specified temperature rise.

PART 3--EXECUTION

INSTALLATION:
Install transformers as indicated on the drawings and in accordance with applicable manufacturer's written instructions, applicable requirements of NEC and National Electrical Contractors Association's "Standard of Installation," and complying with recognized industry practices to ensure that products serve their intended function.

Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer. Mount floor-mounted transformers on vibration-isolating pads suitable for isolating the transformer noise from the building structure. All mounting brackets, seismic restraints, and similar accessories shall be supplied by the manufacturer.

Provide grounding and bonding in accordance with Section 16450.

QUALITY CONTROL TESTING:
Subcontractor-Supplied Testing: Perform visual inspection to determine that the equipment installation conforms to NEC, these specifications, and the drawings.

Inspect and test in accordance with NETA ATS, except Section 4, and as listed in Section 7.2. Measure primary and secondary voltages and make appropriate tap adjustments. The Contractor will witness tests and must be notified in writing 7 days in advance of Subcontractor testing.

FIELD QUALITY CONTROL:
The Contractor's Representative will conduct surveillances to ensure compliance with the drawings and specifications.

END OF SECTION 16460